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Rapid Station Erection

The new turbo-generator station of the Merchants' Lighting Company at Little Rock, Ark., described in our columns this week, is notable as showing that the judicious selection of standard equipment and active superintendence can put a thoroughly up-to-date generating station into commission in an astonishingly short time. The company obtained its franchise contingent on putting the plant into operation within a year—to wit, on June 3 last—and through one source of delay or another it was not until Nov. 15, 1912, that the work was actually begun on the station. Thereafter the work was actually rushed ahead at almost record-breaking pace. The equipment consists of two 1250-kva horizontal turbo-generator sets with turbine-driven exciters, and the whole equipment of the station is of well-known standard types, such as may be obtained from manufacturers on relatively short notice and need exceptionally little inspection after being installed. The only unusual feature of the plant is one enforced by the bad habits of the Arkansas River, which has a 28-ft. rise and fall. The whole condensing equipment has therefore been placed at the bottom of a pit cut out of solid rock to a depth of 41.5 ft. By this means condensation is secured in spite of the worst vagaries of the stream. Notwithstanding the rock cutting thus made necessary and the delays incident to the rainy season, not only the plant but the entire distribution system was ready for operation on May 13, 1913, three weeks ahead of schedule time. It is worth mentioning that the distributing system throughout the entire business district of the city is laid underground, the first distribution of this kind in Arkansas. Tests of the completed station show one interesting feature in the very successful use of ordinary slack coal costing only $2.10 per ton in the bunkers. The coal consumption is reported as 3.6 lb. per kw-hr., while the water rate on a considerably underloaded turbine is 37.5 lb. per kw-hr. The evaporation of a little more than 10 lb. of water per pound of coal thus shown is striking evidence of the efficiency of a well-fired water-tube boiler.

Ozone Machines and Public Health

We print on page 1093 of this issue an interesting letter from Dr. Charles P. Steinmetz commenting on an abstract we recently published of an article in the *Journal of the American Medical Association* on the use of ozonators for air purification. We quite agree with Dr. Steinmetz that the subject of ozone, in relation to the air we breathe, is very large and should be investigated jointly by chemists, physiologists and electricians. It is unfortunate that excessive claims have been made for ozone by over-enthusiastic panacea agents, on the one hand, and these have been met, on the other hand, by somewhat drastic countercharges from certain members of the medical profession. No reasonable person is likely to dispute the proposition that air containing a relatively high concentration of ozone is unfit for breathing. This does not necessarily contravene the use of ozone as a purifier and disinfectant. It might be pointed out that the subject of ozone in relation to ventilation was commented upon in our editorial columns (page 266, Aug. 9, 1913) and was discussed in the correspondence columns on Sept. 6 and 13, 1913. It seems to be generally admitted that ozone is a powerful natural oxidizing agent in nature, and that one of the hygienic advantages of living near the ocean is the presence of a certain small percentage of ozone in the air. There can be no question as to the benefits derived from ozone in the artificial sterilization of water. Like any other germicidal substance, an excessive quantity may be dangerous to health. Meanwhile, both exaggerated claims and exaggerated alarms are not likely to produce any useful result, except perhaps to stimulate cautious and scientific investigation over the very large field brought into discussion.

Energy Supply for Chicago Railways

In this issue we print a synopsis of the important contracts recently entered into by the Commonwealth Edison Company of Chicago and the local electric railway companies. These agreements are the outcome of long-continued and thorough study of the economies of electrical generation and transmission. They furnish an eloquent testimonial to the reliability of central-station service, for this quality is the chief requisite of railway operation. Delays in transportation not only involve direct loss, but the indirect results are even more serious. The public, increasingly critical, is particularly sensitive to loss of time through poor service. Cheap energy is, therefore, expensive in the long run if the service is unreliable to any considerable degree. The fact that the electric railways in Chicago are willing to assume the risks connected with the purchase of such a vital element of their existence as their energy supply means that the past five years' experience has convinced them that it is safe to depend upon the central station for continuity in service. This is a most significant fact. From the standpoint of the central station the arrangement seems quite ideal. Until now there have been several transmission systems, including substations, covering the same territory. Each of these separate systems must be provided with extra machines for expansion and for emergency purposes, with low operating load-factors, very much lower indeed than those of the power plants.

The combined cost of three systems is obviously much greater than one, even with the same total rating, but the rating of a combined system need not be so great as that of its components. Not only is the necessary reserve smaller, but the element of diversity acts to increase the load-factor. Incidentally, danger from electrolysis is minimized because of the reduction of the amount of conducting material underground and the consequent higher resistance in the path of the stray currents. In the case of the Chicago elevated railways the Commonwealth Edison Company gains a great advantage in the provision to use the overhead structures for carrying cables. Such construction will not only be cheaper than underground conduits but the cost of preventing electrolytic troubles will be reduced. Taken altogether, the new contracts are evidence of progress and their consummation is cause for general congratulation.

Hasten Water-Power Development

There was much disagreement in the fifth National Conservation Congress, but there was agreement on certain principles of first importance. If we disregard the politics, stump speeches, resolutions and by-plays with which the proceedings were filled, we find that some real progress was made. It is fortunate that the members of the water-power committee were able to agree on a statement of principles and that the division which led to a majority and a minority report did not nullify its treatment of the entire subject. The statement of principles adopted by the convention affords a groundwork for constructive progress which should be used effectively and have more enduring life than the political by-plays which tended to obscure the real work done. An introduction to the statement of principles recognizes first the wisdom of applying to water-powers the regulation and control that are held over other enterprises operated under governmental franchises. Regulation is a well-established, sound public policy in this country. If properly directed, it protects both the public and the utility. If successful, it will be invoked to safeguard the investor's interest and the consumer's interest in water-powers as well as in other franchise-receiving properties. The principles further recognize that for the purpose of preserving other natural resources which can be exhausted the development of water-power with proper safeguards of the public interest should be earnestly encouraged and hastened. Agreement on this point means much.

The only way to encourage and hasten development is to make contracts for the utilization of water-power. As in every other act of barter, this involves two parties. The government represents one and capital the other. If the government terms are onerous, capital will not invest. If the government terms are sufficiently favorable, capital will compete. If capital does not compete, it is because conditions are not sufficiently attractive to make it do so. If the parties to a bargain under discussion fail to get together, the result is the non-utilization of resources which all deplore. This is what all want to prevent. If "monopoly" is willing to develop while other capital is not, then it is better for the country that "monopoly" should furnish the funds. "Monopoly" is used here to represent the pilloried object of attack of those who rail against concentration of water-power development. If the desire is to prevent concentration, the remedy is to surround franchises with such alluring assurances of great gain as to cause a stampede of capital toward these enterprises. When the contrary policy is favored and the possible profits are unduly reduced, capital is repelled and the project falls to those who are best equipped by experience and resources to take the slim chance left.

As a matter of fact, so-called monopoly capital is only another term for banking capital. Banking capital is the commodity of the banker that corresponds to the merchandise of the merchant. Banking capital becomes true investor's capital when the securities of which it is the basis are placed upon the public market. There is no actual monopoly of capital. As in all other forms of industry, so it is in water-power development. Some will lead where others are content to follow or to take no part at all. Some see opportunity where others hesitate to take risk. Some forego immediate profits for the chance of future greater profits. Those who take risk are entitled to profits; those who balk at risk lose profit. If a franchise is granted and utilization of the water-power fails to prove profitable, the loss is on those who make the investment. The latest water-power development to be made commercially available was nine years in process of construction. What business man or individual accustomed to figuring interest carefully will say that the chance of profit should not be commensurate with risk in such a case?

The principles recognize that the franchise or privilege should be irrevocable except for cause for a definite period, sufficient to be financially attractive to investors. The proper theory is that this period should be long enough to assure such amortization of cost of the property as will lessen the element of risk to a point where the chance of protection and rate of return will induce capital to invest. In theory this should mean absolute protection. Practically it does not, because investors are frequently careless and take undue risks. After the expiration of this period, the principles declare, the privilege should continue, subject to revocation by the government upon payment of the value of the physical property and improvements. An amplification of this clause is found in another section which provides for compensation equal to a fair valuation of the property, exclusive of franchise and consequential damage. No definition of fair valuation is attempted. The other principles deal mainly with redetermination of the compensation at intervals of not over ten years and with the general subject of compensation, make the privilege unassignable except with the approval of the government, and provide for the development of the whole capacity of the site as rapidly as the granting officer may require with consideration of market demands and conditions. The paragraph relating to compensation recognizes the close relation between rates and compensation and the fact that local regulation of rates may affect the compensation to the detriment of the investor. This raises a problem that will be difficult to solve in the event of a dual control such as this provision recognizes may arise. It seems as if the government, rather than the rate-regulating body, would have the controlling voice in such an event.

Daylight and Artificial Light

One of the standing puzzles in illumination is the extraordinary difference that manifests itself between the conditions of daylight and artificial illumination. Perhaps the most commonly noticed feature of the matter is the extreme difficulty of adding artificial illumination to daylight as, for instance, when dusk approaches and lamps must be placed in service. The first results are usually unpleasant and the best plan is to pass suddenly from one method to the other by lowering the window shades and using all the lamps. Many explanations have been offered for the phenomena involved, the difference of direction, of color and of intrinsic briliancy being the three things most prominently considered. There is no doubt that good seeing is facilitated in the passage from daylight to artificial light by preserving the same direction in general for both cases. To change from a left-hand to a right-hand lighting, or the reverse, is somewhat annoying, apparently for purely psychological reasons which after all weigh heavily in such methods.

The color difficulty might be considerable in the case of daylight lighting from a bright sky, but the same reasoning does not apply to lighting by the late afternoon sun, which is of a color quite comparable with artificial light. One can look at a ruddy sunset with comfort and yet resent a change to tungsten lamps. The difference in intrinsic brilliancy may perhaps be a more important factor in the results than either of the others. It would be interesting to know, for instance, whether in going through a school one would find a great difference in the average pupillary diameter by fading daylight and by good artificial light. It is not at all impossible that with the very low intrinsic brilliancy of daylight the pupil opens out considerably more than it would at approximately the same total illumination received from artificial sources placed, as they generally are, even fairly well out of the field of view. In this particular the sharp contrasts often found in artificial lighting may be a handicap to some extent.

Most attempts to diffuse artificial light, as, for instance, in indirect or semi-indirect illumination, produce a result that is lacking in definite direction, while natural light in almost every instance is very strongly unidirectional. It frequently varies enormously in intensity from points near the window to those well within the room. It varies indeed to an extent that would be regarded as absolutely impermissible in artificial lighting, and nevertheless the windows may give on the whole very good light everywhere. It would be a valuable experiment to make actual trial in a good-sized room to reproduce daylight conditions as did Dr. Herbert E. Ives in some valuable recent experiments in a small room. Of course, when there is any marked change in intensity of illumination the eye has to go through a certain process of adaptation, but the major part of this process is a very brief one, although it may bear an important relation to the case in hand.

The truth is that one of the large problems that confront the illuminating engineer is not the mere furnishing of a certain number of lumens from sources inoffensively placed, nor is it to distribute these lumens in a reasonably uniform way. It is to find out the specially advantageous features of daylight lighting and to attempt to reproduce them in a practical way. As a rule the same persons are not intimately conversant with both kinds of lighting, and as we have pointed out, there are matters of psychology to be dealt with as well as physiology and pure engineering.

The subject ought to be taken up by some unbiased body, such, for example, as the committee on the American Medical Association, and, if possible, at least the conditions of the problem sufficiently well determined to encourage attempts at solution. As it is now, it is possible to design excellent natural lighting or first-rate artificial lighting, each after its own kind and each based mainly on empirical data. What is acutely needed in the analysis is such a study as will put both on a scientific basis. The amount of data bearing more or less directly on the topic is appallingly great, but the experimental facts are quite without proper co-ordination in the present state of affairs, and with the new illuminants that are being developed a thorough investigation of the situation is greatly to be desired. We put the matter before our readers in the hope of arousing some much needed activity.

Energy Losses in Transmission Towers

When energy-transmission wires are carried overhead on ordinary wooden poles there is no appreciable loss of energy in the poles, but when high-tension lines are carried on steel poles or towers the steel of the structures becomes magnetized to some extent, and energy losses take place, due either to eddy current or hysteresis, or to both. This is particularly likely to occur if any one of the wires passes through a closed loop of steel in the structure of the tower. The only question of importance to the electrical engineer is whether the losses thus incurred are sufficiently great to be serious from any practical standpoint. An article in this issue throws light upon the question in the case of a particular type of tower structure, where losses might be clearly anticipated owing to the threading of the tower structure by one of the overhead conductors.

The tests described indicate that the losses likely to be encountered with 150-kv transmission over 240 miles on such towers is not serious. They also show that the permeability of the steel members subjected to the working mmf at 100-amp line-current was 935. The actual losses measured show an increase faster than the first power of the frequency and also roughly proportional to the square of the current at 60 cycles per second. It would seem, therefore, that hysteresis plays a minor part in the losses, and that eddy currents assume the major part. A full discussion of the observed losses would be likely to develop considerable interest, although they might also develop considerable complexity. Although, with attention to structural details, the iron losses in tower lines may not attain serious proportions, yet it is interesting to note that it may prove desirable to take them into account. In this way not only dynamo machines but also transmission lines may have to be debited with iron losses as well as copper losses.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Results of Boston Electric-Vehicle Salon

It is unofficially stated that the recent electric-vehicle salon held at Boston under the auspices of the Electric Motor Car Club of that city resulted in the immediate sale of electric passenger cars to the value of $40,000, and that 2500 persons of recognized social and financial standing visited the display during the three days it was open. In effect, every other car exhibited was sold during the salon.

Accident Prevention Committee of N. E. L. A.

An accident prevention committee has been appointed by President J. B. McCall of the National Electric Light Association. The first meeting of the committee was held in Rochester, N. Y., on Nov. 19. Several business sessions were held by the committee and time was taken for inspection of the plants of the Rochester Railway & Light Company and various interesting features of the city. The committee went carefully into the work of the general safety committee of the Rochester company.

The following were appointed members of the accident prevention committee: Messrs. Martin J. Insull, M. W. Alexander, Alexander Taylor, J. B. Douglas, H. W. Moses, H. L. Lucas, T. A. Kenney, Victor Noonan, Dr. E. B. Rosa and Charles B. Scott, secretary.

Activities of the Commercial Section, N. E. L. A.

The Commercial Section of the National Electric Light Association, of which Mr. T. I. Jones, of Brooklyn, is chairman, is busily engaged in rounding out its work for the next convention. The various committees and subcommittees meet at regular and frequent intervals either at the association headquarters in New York City or elsewhere, at the convenience of the committees, to discuss the different phases of Commercial Section work. As noted in these columns last week, the committee on wiring of existing buildings, of which Mr. R. S. Hale, of Boston, is chairman, met in New York on Nov. 19. On Nov. 20 the "Electrical Salesman's Handbook" committee, Mr. C. J. Russell, of Philadelphia, chairman, met at association headquarters in New York. All the members of the committee were present. Details for the revision of the solicitors' handbook were discussed and plans laid to make the publication of the greatest possible value to members of the section. The committee hopes to issue the first section of the revision some time during January.

The committee on non-peak and high-load-factor business met at the association offices on Nov. 21 and outlined the work for the year. In addition to the chairman, Mr. George H. Jones, of Chicago, the following members of the committee were present: Messrs. John C. Parker, of Rochester; C. H. Stevens, of Brooklyn; C. A. Greenidge, of New York, and R. H. Tillman, of Baltimore. The plans outlined include a description of each class of business to be covered, its salient features and the points to be considered in securing the business. The next meeting of the committee will be held during January, but the date and place have not yet been decided.

Mr. Parker H. Kemble, of Cincinnati, chairman of the committee on electrical merchandising and advertising, has called a meeting of his committee for Dec. 5 in Cincinnati. This will be the first meeting of the committee, and the policies and plans for the year will be discussed.

The first meeting of the committee on education of salesmen, Mr. F. C. Henderschott, of New York, chairman, will be held on Dec. 5 at the National Electric Light Association headquarters in New York.

The executive committee of the Commercial Section will meet at Nela Park, Cleveland, Ohio, on Dec. 8. Through the courtesy of the National Electric Lamp Association automobiles will take the committee from the Hollenden to Nela Park, where a meeting room will be placed at the disposal of the committee.

Electric Buses Recommended for New York

The Electric Vehicle Association of America is lending its support to the People's Five-Cent Bus Company in its fight for a franchise to operate twenty routes in New York City. Various electric-vehicle interests are rallying to the support of this concern, which had a hearing before the Board of Estimate on Nov. 13. Among the speakers at this hearing were Mr. Frank W. Smith, president of the Electric Vehicle Association of America, and Mr. M. R. Hutchison, representing Thomas A. Edison. Mr. Smith presented evidence of the ease of operation of electric vehicles and their simplicity of control. He stated that within New York City are 500 enthusiastic owners of electric trucks, using 2100 of these vehicles, and that these owners would be willing to testify as to the greater safety in operation of electric vehicles. Mr. Edison submitted through his representative, Mr. M. R. Hutchison, the following letter: "I believe that for traction in cities the electric motor will displace all other motors. Already it has displaced steam on street cars, elevated railways and subways. It drives all of the elevators and most of the machinery in the city. If buses are desirable for inter-city traffic, the electric is the only practical one. It is noiseless, has half the destructive effect of a gasoline engine, and can be stopped quicker than the gasoline vehicle, with the added economic value of much cheaper operation."

Government Suit Against Bell Telephone Companies

In the suit brought by the United States against the American Telephone & Telegraph Company, the Pacific Telephone & Telegraph Company and the Mountain States Telephone & Telegraph Company, the government alleging restraint of trade in violation of the Sherman law by the stifling of telephone competition in Washington, Oregon, Idaho and Montana, hearings have been held in a number of cities before Miss Mary E. Bell, of Portland, Ore., special examiner for the Department of Justice. Witnesses have been examined in Portland, San Francisco, Tacoma, Seattle, Spokane, Butte, Denver and Chicago. The taking of testimony in Chicago began on Nov. 19. Mr. W. S. Vivian, of Grand Rapids, Mich., and Chicago, secretary of the new Independent Telephone Association of America, was the first witness in Chicago. Mr. B. G. Hubbell, of Buffalo, president of the Federal Telephone & Telegraph

Company, an independent concern, was the next witness.

On cross-examination Mr. E. S. Pillsbury, of counsel for the Bell companies, brought out the fact that the Federal Telephone & Telegraph Company is a consolidation of about eighty-five operating telephone properties in western New York. Mr. E. D. Schade, an independent telephone operator of Johnstown, Pa., told of the situation in his neighborhood. Mr. John Z. Miller, of Erie, Pa., and other witnesses also testified on behalf of the government. It is probable that hearings will be held in New York and Philadelphia.

Main-Line Electrification of Chicago, Milwaukee & St. Paul

Before Jan. 1, probably, the Chicago, Milwaukee & St. Paul Railway Company will have reached a decision as to the type of equipment to be employed for the extensive main-line electrification of its railroad over the mountains in Montana. It is practically certain that the overhead trolley system will be used to convey the electrical energy to the motors on the electric locomotives. Either the 14,000-volt, 25-cycle alternating-current system will be used or the direct-current 2400-volt system. Plans which have been submitted by the General Electric Company and the Westinghouse Electric & Manufacturing Company are now under consideration. For the railroad company the entire matter of electrification has been placed in the hands of Mr. C. A. Goodnow, vice-president in charge of operation and construction.

At first it is proposed to electrify a division of the railroad 113 miles long, extending over the Rocky Mountains between Three Forks and Deer Lodge, Mont. This work will be begun early in 1914. Ultimately the electrification will be extended to that portion of the main line between Harlowton, Mont., and Avery, Idaho, a main-line distance of 440 miles and, including sidings, a total of 450 miles of track. This work will mean an outlay on the part of the railroad company of perhaps $6,000,000 or $8,000,000, and the electrical construction work will proceed at such a rate that the annual expenditure will be about $1,500,000 or $2,000,000.

Experience with heavy railroad operation in and near New York City shows that electric locomotives can be run 2000 miles without inspection under the conditions existing there. The locomotives which will be placed in service on the mountain divisions of the Chicago, Milwaukee & St. Paul can be relied upon to make from 250 to 300 miles at the outset. As there will be no delays for coaling, taking on water, cleaning fires or waiting for steam, it seems a fair conclusion that the tonnage will be handled with fewer locomotives, higher average speed and with a regularity which will result in better operating conditions. Passengers will be able to enjoy the mountain scenery without the annoyances incident to steam locomotion. Another point of interest is that while the steam locomotive is at its worst in freezing weather the electric locomotive is at its best at that time, since practically the only difficulty with the electric locomotive is to keep the motors from heating when doing maximum work.

One of the important benefits to result from electrical operation is the regenerative control of trains descending mountain grades by means of which energy will be returned to the line.

Energy will be purchased from the Montana Power Company as already noted in these columns. The plans of the power company for carrying the railroad load were outlined in our issues of Dec. 21, 1912, and Jan. 11, 1913, and the details of the contract between the railroad company and the power company for energy were published in our issue of Feb. 8, 1913. Other details of agreement between the power company and the national government were outlined in the issue of Jan. 11, 1913.

Ozone Machines and Public Health

In our issue dated Nov. 15, on page 993, appeared an abstract of an article entitled "The Alleged Purification of Air by Means of the Ozone Machine," which had been published in the *Journal of the American Medical Association*, by Dr. W. A. Sawyer, director of the Hygienic Laboratory of the California State Board of Health, aided by H. L. Beckworth and E. M. Skolfield. We publish below a letter from Dr. Charles P. Steinmetz containing some interesting comments on the experiments mentioned in our earlier issue and giving valuable suggestions for a proper investigation of the subject under discussion.

To the Editors of the Electrical World:

SIRS:—On page 993 of your issue of Nov. 15, under the title "Ozone Machines and Public Health," I have read an abstract of some investigations on ozone published in a recent number of the *Journal of the American Medical Association.*

While I personally do not like the smell of ozone and therefore do not care to have it about, nevertheless some of the conclusions reported by the experimenters appear to me inconsistent, so that it may be well to caution the reader against accepting them without further evidence. For instance:

Guineapigs were harmed and killed by a very high concentration of ozone, and from this the conclusion is drawn that an extremely low concentration of ozone is harmful. With the same reasoning, since guineapigs kept in pure oxygen are harmed and killed, the conclusion may be drawn that the 20 per cent of oxygen contained in the air which we breathe is harmful and that we are all in imminent danger of death. Any corrosive non-poisonous agent in sufficient dilution becomes harmless, and while, for instance, the drinking of concentrated hydrochloric acid would be fatal, free diluted hydrochloric acid normally exists in our stomachs as an agent of digestion.

Also, the report states, ozone in higher concentration destroys odors, while in low concentration it "masks" them. It is hard to conceive, without very conclusive evidence, why the action of ozone should be different in one case from its effect in the other.

The experiments with bacteria described are hardly remarkable. I believe any chemist would have predicted that under the conditions of the experiment ozone should have no effect on bacteria.

Ozone is active oxygen, and as such at ordinary temperatures gives many of the reactions which ordinary oxygen exhibits at incandescence; that is, it oxidizes or burns combustibles, such as organic matter. Thus an oxidizable gas, such as the smell of a smoldering tallow candle and most organic smells indicate, should be destroyed sooner or later, depending on the concentration, while a non-oxidizable gas, as, for instance, that indicated by the smell of chlorine or nitric oxide, would not be affected by ozone.

As dryness interferes with chemical action, it should be expected that dry bacteria would be very resistant against ozone. As the action of ozone is oxidization or combustion, bacteria contained in jelly could be affected only by the complete destruction of the jelly. Or bacteria in drinking water containing large amounts of organic impurities could be destroyed only by quantities of ozone sufficiently large to burn up the entire organic matter. For this reason, in water sterilization by ozone, previous filtration is generally used. The last number of *Chemical Abstracts* (Nov. 10) gives a list of nine European cities in which water sterilization by ozone is in successful operation, and abroad such public works are not constructed without previous comprehensive study of the process by competent scientific authorities.

In view of the rapidly increasing industrial application of ozone, on the one hand, and the many wild claims made

tor it by quacks and humbugs, on the other, it would in the interest of the electrical industry be extremely desirable if a comprehensive and impartial investigation on ozone and its industrial, domestic and medical use were made by a competent group of scientists. Such investigations, however, could not be carried out by men of one profession only without leading almost certainly to wrong conclusions caused by generalizations from special cases, as I pointed out above. A proper study of the problem, indeed, would require the co-operation of competent physicians, physicists and chemists.

In the literature of ozone at present there seems to be practically no statement which is not flatly contradicted by exactly the opposite statement made by equally high authority.

Schenectady, N. Y. CHARLES P. STEINMETZ.

The Industrial Truck for Handling Freight

At the meeting of the Electric Vehicle Association of America held in New York on Nov. 25 a paper entitled "The Industrial Truck as a Factor in the Efficient Handling of Internal Freight" was read by Mr. W. W. White, of the General Vehicle Company. Preceding the presentation of Mr. White's paper, Chairman F. W. Smith called on Messrs. C. D. Marsh, Day Baker and E. S. Mansfield to tell of the electric-vehicle salon at Boston. The co-operation of pleasure-vehicle, commercial-vehicle and central-station people in making the exhibition at Boston a success was described, and Mr. Baker illustrated his remarks with several lantern slides showing views of the ballroom of the Copley-Plaza Hotel, where the salon was held.

In his paper Mr. White classified as industrial trucks the battery-truck crane, the freight truck, the baggage truck and certain kinds of tractors. Each type has its special fitness for certain kinds of work, the freight truck in particular being very elastic in the range of service performed and also in the special equipment which may be added, such as hand-winches, small hoists, booms, etc. The simple industrial or freight truck is built in sizes and capacities suitable for moving loads on piers, in freight sheds, warehouses and industrial establishments generally. Its clearance and radius of action permit it to pass through congested places, going forward and backward with ease and facility, and it is capable of ascending gradients of 10 to 25 per cent. On piers and railway terminals it can deliver its load on the deck of a vessel or within a freight car. The capacity of such trucks is usually 2000 lb., as this rating has been found the limit for trucks capable of the widest range of action.

Since approximately 75 per cent of the 300,000 railroad and steamship freight handlers push hand trucks, and since these hand trucks can unquestionably on a four-to-one basis be reduced to 55,000 by electric trucks of the proper type, the possible economies in the internal handling of freight by common carriers become apparent. The greatest saving derived in using an industrial truck is in labor, a single truck often displacing four or five men.

In the discussion following the reading of the paper, Mr. Day Baker spoke of the ignorance of the average industrial-truck operator and the provision often made to have the truck stop automatically should the driver jump off his platform suddenly on account of fright or negligence. Mr. H. L. Stockbridge said that the companies are beginning to realize that trained men are required to operate these trucks.

Mr. White, in reply to a question concerning tires, said that rubber has been found to be the best material, and unless the trucks are excessively loaded the tires will hold up very well. He explained that batteries last twice as long with industrial trucks as with street trucks because the vibrations are less and the cycles of charge and discharge are maintained more uniformly.

Rival Telephone Associations

The Independent Telephone Association of America has been formed with headquarters in Chicago. The National Independent Telephone Association has been in existence for a number of years, representing companies that compete with the American Telephone & Telegraph Company and its subsidiaries. Within the last two or three years, however, it has been charged that some of the prominent men in the National association have been openly or secretly affiliated with the Bell interests and within a year two associations of dissatisfied independents have been organized. These were the United Independent Telephone Association of America and the Telephone Service Association. On Oct. 18, at a meeting in Chicago, the Independent Telephone Association of America was organized, and the members of the Telephone Service and United associations became members of the new organization. The officers are: President, Mr. E. B. Fisher, Grand Rapids, Mich.; vice-presidents, Messrs. G. W. Robinson, St. Paul, and E. D. Schade, Johnstown, Pa.; secretary, Mr. W. S. Vivian, Chicago and Grand Rapids, Mich. Mr. Frank L. Eldridge was made manager of the telephone service department. The directors include Messrs. Richard Valentine, Janesville, Wis.; W. J. Uhl, Logansport, Ind.; Samuel Hill, Portland, Ore.; J. H. Wright, Jamestown, N. Y.; B. G. Hubbell, Buffalo, N. Y.; E. N. Cooke, Philadelphia, and others.

The constitution of the new association provides that the association shall be composed of telephone companies 'independent of and not owned and controlled by the American Telephone & Telegraph Company, directly or indirectly." The annual meeting of the new association will be held in Chicago on Feb. 10.

Progress of Coon Creek Development on the Mississippi Near Minneapolis

Construction work on the Coon Creek Rapids hydro-electric development of the Northern Mississippi River Power Company, 11 miles from Minneapolis, is being pushed along rapidly by the engineers and constructors, H. M. Byllesby & Company. Seven hundred men are now engaged on the dam, which, it is planned, will be completed by January.

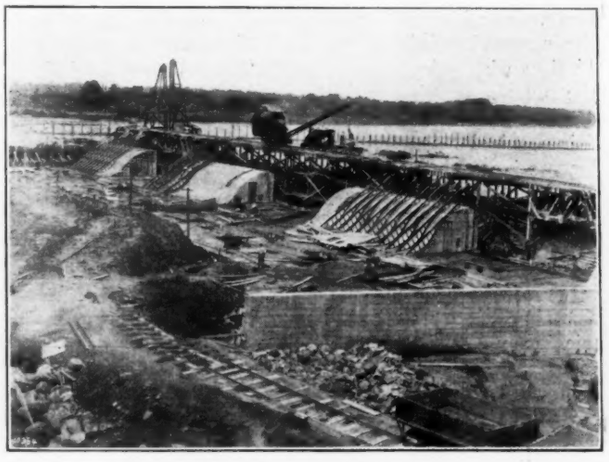


FIG. 1—SPILLWAY UNDER CONSTRUCTION

All except three 54-ft. sections of the dam are completed now, and these will be left open for water to pass through until everything is in readiness for filling the reservoir. Closing these sections will require only a few days' work, as piles have been driven and the apron for the entire dam

has been completed. The draft-tube sections in the power house are in place and five of the seven concrete scroll cases have been poured.

The generating station will utilize a head of 17.5 ft. and have an initial rating of 10,500 hp, developed by five units, although eventually seven units will be installed, with a total rating of 14,700 hp. The new plant will supplement the power resources of the Minneapolis General Electric Company and is to be tied in electrically with the 45,000-kw system which includes two other water-power plants, located at Taylor's Falls and St. Anthony Falls, and three steam stations, located in Minneapolis and St. Paul. Since all six stations will be operated as one system, no water-wheel-driven exciters have been provided for the Coon Creek plant. Instead two 300-kw motor-driven sets will be installed, the second unit being held as a reserve.

At the site of the new plant the Mississippi River formerly flowed through two channels separated by an island. A spillway dam 1000 ft. long has been built across the wider and shallower channel, and the plant structure has been built over the narrower and deeper channel. The entire works thus consist of earth embankments with core walls 557 ft. long, the power house and retaining section, 498 ft. long, including sluicegates, log chute and fishway, and the spillway, 1000 ft. in length, making the total length of the construction 2055 ft.

The illustration shows the spillway under construction with its steel-trussed forms used in shaping the alternate sections and later employed with stop logs to close up the remaining sections. The spillway dam, which is of solid-concrete, gravity type, is built on a foundation of round piles driven to hard-pan, with two rows of sheet steel piling for cut-offs. Capping it will be twenty-eight Tainter gates used to regulate the level of the water in the reservoir. Each gate has a clear opening of 33 ft. and weighs 12,000 lb.

The forms for the draft tubes were constructed in sections, which are removed after the concrete sets and used over again. Construction of the large draft-tube and scroll-case forms in such sections has the advantage of allowing the sheeting to be placed on the shore and accelerates erection, since both forms and excavation can proceed at the same time. Each tube is designed to discharge 1320 cu. ft. per second at 17.5 ft. head. The spillway has

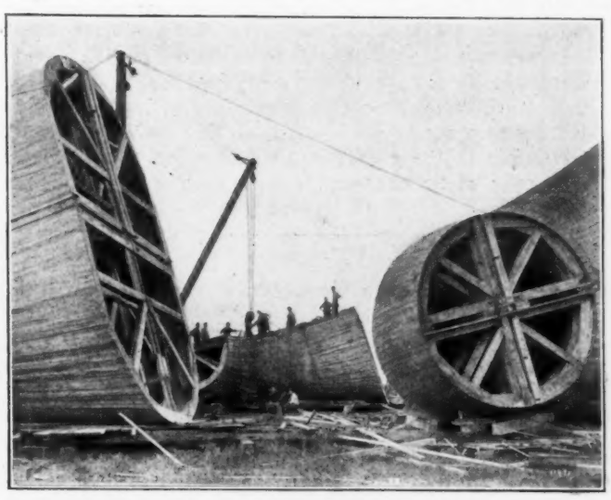


FIG. 2—FORMS FOR DRAFT TUBES

been designed for a maximum flow of 80,000 second-ft., although 60,000 second-ft. is the maximum stream flow of which there is any record.

The plant building will be of brick with a structural-steel frame and concrete floors. Allis-Chalmers vertical-type single-runner waterwheels will drive General Electric direct-connected generators rated at 1625 kva and 2300 volts at 62 r.p.m. These machines will deliver three-phase, 60-cycle energy to the station bus, from which it will be stepped up to 13,200 volts by delta-connected 1375-kva General Electric transformers. This combination of 2300-volt generators and step-up transformers was found to be less costly than equivalent 13,200-volt alternators would have been under the conditions of low speed and large size imposed by the low head available.

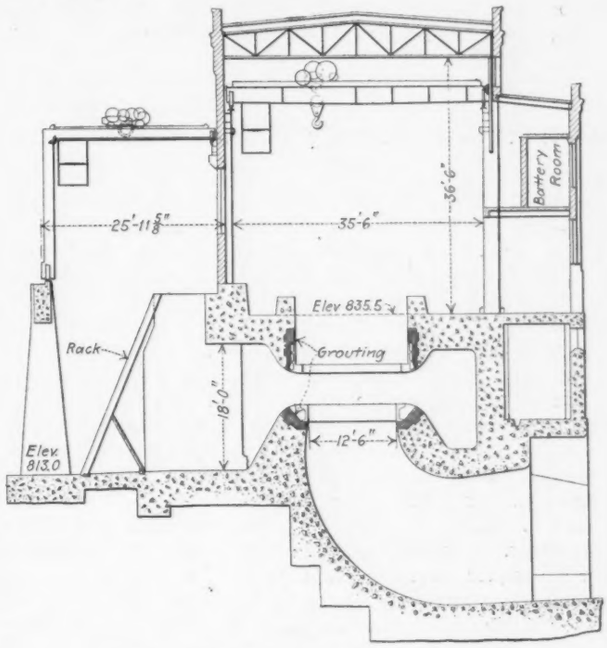


FIG. 3—SECTION THROUGH POWER HOUSE

A three-phase transmission line of 250,000-circ. mil conductor cross-section connects the Coon Creek site with Minneapolis. Later, another line will be built north to the town of Anoka.

Combination Distribution System for Panama

A committee, consisting of Mr. H. Rowe, chairman; Mr. C. L. Bleakley, Mr. R. K. Morris and Capt. W. H. Rose, appointed to consider lighting, power, telephone and fire-alarm systems for the permanent towns on the Panama Canal Zone has investigated three types of construction, as follows: (1) Overhead construction, where the wires are carried on wood, concrete, or steel poles; (2) underground construction with armored cables, where the wires are inclosed in lead-sheathed cables, which are protected from mechanical injury by a steel band or wire armor, the cables to be laid directly in the ground with no other form of protection; (3) underground conduit construction, where lead-sheathed cables are pulled through underground conduit composed either of vitrified clay or bituminized fiber ducts laid in concrete, with concrete manholes at intervals varying from 250 ft. to 500 ft.

The committee was unanimously of the opinion that the overhead system should be discarded in the permanent towns, but in view of the fact that in these towns the present roads and buildings will probably be used as long as their upkeep is not excessive, the committee recommended a combination system based upon the following:

In case of entirely new town layout and construction, the underground conduit system should be installed at the same time as other permanent structures, such as roads, buildings, sewers, etc. In the case of branch lines to isolated buildings or to isolated small groups of comparatively unimportant buildings, the armored cable system could be used for the lighting and power circuits, and an under-

ground lead-covered cable, without armor, for telephone, telegraph and fire-alarm circuits.

In case of the towns now existing, which will remain as permanent towns, but in which structures will later be replaced by permanent ones, the underground conduit system should be installed in such locations as will not have to be changed later on. The underground armored cable system may be used where this fact cannot be determined, where topographical conditions are unfavorable, or in serving isolated buildings or groups of buildings.

Strike at Schenectady Works of the General Electric Company

Labor troubles at the Schenectady works of the General Electric Company have resulted in partial cessation of work there. On the morning of Nov. 25, after negotiations between the company and representatives of the men, from one-third to one-half of the employees struck. During the day many of those who had remained at their posts in the morning left their work. A number of the men have since returned to work, and at the time this issue went to press about 13,000 were out. The men say it is a "demonstration." Two workers who were laid off are the ostensible cause of the trouble. These employees were said to have been active in union matters and for that reason the action taken by the company in regard to them was made the basis of a strike. However, other definite causes which had a potent influence in the matter were the existence of unions among the employees between which there has always been strong feeling. These unions were branches of the Industrial Workers of the World and the American Federation of Labor, between which there is strong opposition. According to reports from Indianapolis, executive officials of the American Federation of Labor sent telegrams from that city to representatives of local unions at Schenectady urging strongly that no strike be called at this time and for the reasons advanced in this case. Another important element in the stiuation is the political unrest existing in Schenectady because of the socialist factor in city politics. The term of office of Mayor Lunn, the socialist head of the city, expires on Dec. 31. The political sentiment arising from the defeat of the socialist ticket at the last election is accentuated by the approaching retirement of Mr. Lunn from office.

Mr. G. E. Emmons, manager of the Schenectady works, made the following statement in regard to the strike on Nov. 25:

"Owing to a falling off in business it has become necessary for the General Electric Company to reduce force in all of its apparatus factories, the Schenectady works being the last to be affected. Instructions were accordingly issued to the superintendents of the various divisions directing that such reductions in force as were necessary to meet business conditions should be made. In line with such instructions, the superintendent of the wiring device department, where a falling off in business was especially felt, directed that a considerable number of employed be laid off. Without any intent to discriminate against any individuals or class of employees, it happened, on the merits of the case, that a certain man and woman who had been prominent in labor matters were laid off, among others, in the department where they were employed. The man, a plater, was the last to be laid off in his particular line of work in the department involved. The woman was employed with eleven others upon a certain class of work. In selecting those to be laid off consideration was given to the term of employment, and the six who were retained have been longer in the employment of the company than any one of the six laid off. After notice of lay-off had been given a committee waited upon General Superintendent Smith, claimed that undue discrimination had been used in laying off the two employees, and demanded their reinstatement.

"This was followed by further conferences, and Saturday morning the matter was first officially brought to the attention of the manager of the works, who, with a committee representing the employees, held a prolonged discussion, with the result that it was agreed that an investigation should be made by General Superintendent Smith, the foreman of the department involved and the committee representing the employees, and that the matter should be treated upon its merits. The committee was informed that the manager of the works would be out of town Monday and therefore could not again be seen until Tuesday morning. An investigation was begun Monday morning, which lasted until after 1 o'clock, when the representatives of the employees left the conference. During the conference General Superintendent Smith stated that the company was prepared and willing to give the two individuals transfers to other departments if it could be done without injustice to other employees, and that when business conditions warranted they would be returned to their former positions. This was done to indicate clearly that there was no intent to discriminate. About 2 o'clock the committee returned to state that its members had been instructed to demand reinstatement of the two employees to their former positions before 3 o'clock, or the works would be struck. It was stated that the manager would not be home until 9 o'clock that evening, and the delegates were asked to defer action until they had had an opportunity to further discuss the matter with him. It was Mr. Smith's understanding that the committee would communicate by telephone with the manager upon his return to the city. Mr. Emmons reached his house shortly after 9 o'clock, but no communication from the employees was received by either him or Mr. Smith, and it was therefore understood that no action would be taken until further conference.

"About 3 o'clock Tuesday morning a national representative of one of the unions telephoned to Mr. Emmons asking if the latter would not participate in a conference at 8 o'clock that morning, provided one could be arranged. Mr. Emmons agreed to participate in such conference. While this latter conference was in progress many employees left the plant without waiting for its conclusion and were followed during the morning by a large proportion of the force.

"The management regrets that this action was taken by its employees, believing that it was hasty, ill-advised and unfair to the company, to its employees and to the community of Schenectady."

Action of the Conservation Congress

The Fifth National Conservation Congress, held at Washington last week, resolved itself into what was almost a water-power conference.

The congress, by a test vote of three to one, was clearly in the control of a group of men led by Messrs. Gifford Pinchot, James R. Garfield, Henry L. Stimson, ex-Secretary of War, and Walter L. Fisher, of Chicago, ex-Secretary of the Interior.

Mr. Pinchot was urged by his friends, including Mr. Charles Lathrop Pack, president of the congress last year, who was re-elected, not to force this resolution through the congress. He persisted, whereupon it was reported in the newspapers that Mr. Pinchot and Mr. Pack had agreed to go separate ways in the future.

Mr. Pack denied a quarrel with Mr. Pinchot over conservation and issued the following statement:

"What I did say to Mr. Pinchot was this: 'Gifford, I have

worked with you for ten years and have been your friend. You can't drive me away from you now even though I think it is a grave mistake of judgment for you to bring this question up at this time. The congress has already acted favorably upon the unanimous recommendations of the water-power committee, and most of the members of the committee and a majority of the delegates interested in water-power have gone home believing the water-power subject finally disposed of. To force a vote by a minority of the delegates would be unfair to these people and might alienate many men who have shown themselves true friends of the cause of conservation.'"

Owing to the dissatisfaction of some of the delegates to the congress, who declared that Mr. Fisher as acting chairman had used "steam-roller" methods in his conduct of the congress, the Arkansas delegation withdrew and is attempting to form another conservation congress to deal solely with water-power matters. Mr. Walter Powell, of Arkansas, chairman of that delegation, issued a statement in Washington at the close of the meeting, in which he said he had been delegated by representatives of twenty-three states of the Middle West, West and South to call a separate convention which would take up only the subject of water-power and irrigation. He declared that it would be composed of practical men, not of government officials and former Cabinet officers, and would try to come to some definite conclusion on the subject of conservation from the practical and not the theoretical standpoint. This convention will be held in about a month, and states from Maine to California will be represented. It will probably be held in Washington, though it might possibly be held in St. Louis, Mr. Powell said.

COMMENTS ON THE CONGRESS

Commenting on the action of the congress, Prof. George F. Swain said:

"If the action of the Conservation Congress regarding the merits of the water-power question can be disentangled from all political considerations, I think it will be found that some real progress was made. The water-power committee, while it could not agree on a full report, was nevertheless able to agree unanimously on certain fundamental principles which should govern our water-power policy and which, if adopted, will much improve the present situation. The most important of these were:

"1. The recognition of the right of federal control.

"2. The abandonment of the revocable franchise now required by law and the substitution of the indeterminate franchise having no fixed term, this franchise to be irrevocable and unchangeable for a considerable period, sufficient to make the franchise financially attractive, except that it may be revoked during this period for cause, subject to review by the courts; thereafter the terms to be adjusted at fixed intervals; the government to have the right to take over the property at any time after the first period by paying a fair value therefor, exclusive of the franchise value.

"3. The adoption of the principle that the charge made by the government should be in the form of a division of the earnings above a defined percentage on the money properly invested which the company is to be allowed to earn before any charge is made, except in some instances a small nominal one.

"The essential difference between the two reports was that the majority believed that, subject to the above conditions, and in view of the state regulation almost everywhere existing, there was nothing to be feared from a monopoly of water-power, but that the main emphasis should be placed upon development in order that the use of this resource, the utilization of which saves one of our non-renewable resources, should be encouraged to the utmost.

"The minority report, however, placed the main emphasis upon the prevention of monopoly."

Mr. Gifford Pinchot has summarized his views as follows: "The result will be to strengthen the advocates of development under public control, make it harder for reactionary interests to prevent legislation fair to both sides and so will, in my judgment, tend directly and powerfully to adjust settlement of the controversy and the increase of development, which is what we all want."

Mr. Lewis B. Stillwell said: "The congress has accomplished something that will be valuable in a constructive way. It has placed both sides on record. What is necessary now is to follow up the work of the congress, to have the law providing revocable franchises repealed and one embodying the adopted recommendations enacted."

Mr. Arthur Williams, chairman of the public policy committee of the National Electric Light Association, said: "The action of the congress is the first step in straightening out the inadequate and unfair legislation of the past and in opening up the development of this natural resource on very broad lines and under conditions which protect the government—state or national—the public and the investors and encourage good management. In none of the reports—the majority and minority and the unanimous recommendations—was there any suggestion of penalizing the investor. The use of the term 'franchise,' rather than 'permit,' in the minority report is significant and indicates what should be the true status of a water-power grant. The tendency toward federal rather than state control was also indicated in all reports."

ADDRESSES BEFORE THE CONGRESS

Mr. W. V. N. Powelson read a paper before the congress on Nov. 19. The general object of the paper was to present a measure of the waste of natural resources due to the non-development of water-powers. Mr. Powelson said that a little reflection would show that it is possible that the evil of non-development, if continued long enough, may exceed the evil of unwise development. The true interest of the public lies now between these two extremes. It is not possible to remain in the present situation with a practical embargo on the development of sites now controlled by the government without losses, nor can the country without danger permit the development of these sites unless an efficient governmental control is retained over them after development.

Continuing, Mr. Powelson said that so far it has seemed the part of good strategy to throw away one thing of value to gain another which promises to be of greater value. The country must not continue to throw away until it exceeds the value of the thing it is striving for. There has been ample opportunity during the last three years for reflection, study and the preparation of plans, and the people are now looking to the leaders of the conservation movement to come forward with a practical scheme of legislation that will bring about speedy development of needed powers under efficient public control and thus definitely put a stop to the enormous waste involved in the non-development of these powers.

Senator Theodore E. Burton, of Ohio, in an address before the congress on Nov. 19, said that the amount of energy employed in industry and transportation in the country is estimated at 31,500,000 hp, of which 5,500,000 is derived from flowing water and the remaining 26,000,000 from steam. Coal consumption for 1912 was 427,000,000 tons. In the generation of the 26,000,000 hp by steam more than two-thirds of this quantity of coal was consumed. There is available in the United States 30,000,000 hp from water which can be readily developed. By development an additional quantity, probably 150,000,000 to 200,000,000 hp, could be made available. Senator Burton said that the greatest embarrassment has been caused by the conflict between opposing ideas regarding national and state control. Senator Burton added that one feature of the question most imperfectly comprehended by the general public is yet

of the most potent consequence; that is, electrification of the great transcontinental railways. Railway managers have just awakened to this possibility. It has been estimated that there is water-power which can readily be developed in the Northwestern States sufficient to operate every mile of railway west of a line drawn north and south through the center of the State of Montana and north of a line drawn from the southern boundary of Colorado to the Pacific Coast. This would include some of the great railway systems and the actual saving in fuel consumed would reach $4,000,000. In conclusion, Senator Burton said that the only way to gain benefits from water-power resources is to develop them. There is now a deadlock. The friends of the conservation movement in Congress are strong enough to defeat the efforts of those who seek to put through the unlimited grants of former days. On the other hand, those who believe that Congress ought to continue an obsolete policy are strong enough to prevent the enactment of constructive legislation. Water-power is now the one great asset of the nation which is running to waste and whose value will not be diminished by use.

Wireless Patents Suits

In 1910 the National Electric Signaling Company began suit against the Telefunken Wireless Telegraph Company of America for infringement of United States patents Nos. 918,306 and 918,307, which were issued in 1909 to Prof. Reginald A. Fessenden and are owned by the National company. The case was fought through the District Court, and on Oct. 20, 1913, the United States Circuit Court of Appeals for the Third Circuit (Judges Gray, Buffington and McPherson) handed down an opinion in which the Fessenden patents were sustained and the Telefunken company declared an infringer.

Having these two patents adjudicated, the National Electric Signaling Company at once began an action for injunction against the Marconi Wireless Telegraph Company of America, which is alleged to be one of the largest infringers of the patents. A hearing in this case was held at Trenton, N. J., on Nov. 17, at which time Judge Rellstab issued a preliminary injunction restraining the Marconi company from further infringement except as to its pending contracts with the United States Navy. From the representations of the Navy Department it appeared to the court that a severe inconvenience might result if the Marconi company were not allowed to deliver the instruments already contracted for, so this was permitted by the court under the provision that there be given a bond of $25,000 for the protection of the owners of the Fessenden patents.

Following the order of court described above there was filed a motion to suspend the injunction, with affidavits from the Marconi company's engineers stating that the apparatus complained of as infringing was installed at over 500 stations and that to remove it would require some two months' time. In the argument before Judge Rellstab Nov. 21, at Trenton, ex-Attorney-General John W. Griggs stated for the Marconi company that removing the apparatus immediately, as originally ordered, would so cripple the wireless service that if an accident at sea should occur great loss of life might result. With this in view, Judge Rellstab suspended the injunction temporarily as to existing ship stations and those on shore intended for ship communication, but still restrained the Marconi company from installing the infringing apparatus at any new plants pending final settlement of the case. He further required a bond of $100,000 to guarantee payment to the National company of any damages which may be proved to arise from the partial suspension of injunction.

The invention concerned is a method of sending and receiving wireless telegrams by use of high-pitched sparks. These rapid musical sparks produce a distinct tone at the receiving station and so permit the operator to distinguish them from other and lower-pitched sounds merely by concentrating his attention on the desired signals. Wireless telegraph outfits using sparks of this character have come into general use in the past two or three years and are said to have increased materially the value of wireless service.

Public Service Commission News

District of Columbia Commission

The Public Utilities Commission of the District of Columbia has been ordered by the United States Senate to make an investigation of the affairs and rates of the Chesapeake & Potomac Telephone Company, which operates in the District of Columbia.

Wisconsin Commission

In a decision on the application of the Neshkoro Light & Power Company for authority to increase rates, the Wisconsin commission prescribed a schedule of charges which will effect a decrease in rates. An analysis of the company's accounting methods showed that the accounts had been kept erroneously and that, instead of earning an insufficient return upon the investment, the property was earning approximately 15 per cent. The company had in effect a primary rate of 10 cents for the first 100 kw-hr. used per month. The rates prescribed are as follows: primary rate, 9 cents net for the first sixty hours' use per month of the active connected load; secondary rate, 7 cents net for the next forty hours' use per month; excess rate, 4 cents net. The consumers are divided into classes A, B and C, according to the percentage of connected load, in a manner similar to that used by the commission in the majority of its rate cases.

The rates for motor service are to consist of a charge of $1.25 net per active horse-power capacity per month, plus a charge of 4 cents per kw-hr. for energy used. The active connected load is to consist of 90 per cent of the first 10 hp, 75 per cent of the next 20 hp, 60 per cent of the next 30, and 50 per cent of the connected load in excess of 60 hp. A minimum bill of $2.50 per month is provided for.

The commission criticised the company for the laxity which is apparent in its accounting methods and stated that records, if properly kept in the future, might justify the commission in amending its present decision, to the advantage of the applicant.

The commission has fixed the sum of $137,500 as the price to be paid by the city of Manitowoc for the property of the Manitowoc Electric Company. The city voted to acquire the property under the provisions of the indeterminate permit law. A present value of $132,770 and a reproduction cost of $173,708 were given to the property by the commission's engineers.

The application of the Clinton Telephone Company for authority to extend its lines into the territory served by the Bergen Telephone Company has been denied. It appears that a former subscriber of the petitioner, upon moving into the district served by the objector and failing to receive adequate service, requested the petitioner to extend its lines a distance of about 80 rods to his place of residence. This request was denied by the commission on the ground that it was contrary to the intentions of the Legislature in framing the Kneen anti-duplication law and that to grant the apparently reasonable request would be to establish a dangerous precedent.

The Portage American Gas Company has been ordered to reduce its rates on gas. With a cost new of $112,240 and with depreciation and interest computed at 2 per cent and 7.5 per cent respectively, the commission decided that gas could be sold in the city of Portage for the following rates: first 2000 cu. ft. per month, $1.30; next 3000 cu. ft., $1.20; next 5000 cu. ft., $1.10; next 10,000 cu. ft., $1; over 20,000

cu. ft., $0.90. The present minimum bill of 13 cents per month was abolished and a minimum bill ranging from 25 cents for a three-light meter to $4 for a 200-light meter was ordered substituted therefor.

WEST VIRGINIA COMMISSION

Officials of the Virginian Railway Company protested to the West Virginia Public Service Commission that the construction of a dam 140 ft. high in the New River at Hinton, W. Va., planned by the Virginian Power Company, would interfere with the plans for the construction of a through railroad from tidewater to the great lakes. The Virginian Power Company has asked for approval of a plan to erect eight dams along the New River. The railway company declares that necessary grade changes to avoid a dam of this height would increase the cost of a projected line of railroad $2,650,000, while the cost of a double-track line over the same route would be increased $2,977,470.

NEW JERSEY COMMISSION

The Board of Public Utility Commissioners has addressed a communication to the City Commissioners of Jersey City regarding the proposed investigation of gas rates in Hudson County. The board holds that it would be unwise to make such an investigation at this time inasmuch as the present state-wide rate of 90 cents per 1000 cu. ft. charged by the Public Service Gas Company is far more advantageous to the people of the State at large than if municipal units were established. The attention of the commissioners is called to the fact that even if Hudson County were placed in a separate division for rate-making purposes, little if any actual benefit would result. Supporting this contention, the board points out that the State might be divided into five divisions, as has been suggested, and if so the approximate rates in each would be: Essex division, $0.837; Hudson division, $0.872; Bergen division, $1.17; central division, $1.293; southern division, $1.095, such rates being based upon investigations made by the board recently in the Passaic district.

The board has dismissed the complaint of the Postal Telegraph & Cable Company against the New York Telephone Company to accord it certain reductions in tolls on messages delivered over the company's lines and affirming that such reductions had been granted the Western Union Telegraph Company. The board finds no merit in the complaint as the testimony shows that the Postal company sought only the reduced tolls on inward-bound calls to its customers, whereas the contract between the Western Union and Telephone companies provides for both inward and outward-bound messages. The Telephone company expressed willingness to make a contract with the Postal company similar to that now existing with the Western Union company, but refused to divide it so as to make it applicable only to the delivery of messages.

CALIFORNIA COMMISSION

A decision has been rendered by the Railroad Commission of California declaring excessive and unreasonable all the long-distance telephone rates of the Pacific Telephone & Telegraph Company in California. The commission cut the rates 21 per cent and allowed two minutes for conversation as against one minute heretofore allowed. The commission's order required that 30 per cent of long-distance revenues be credited to city exchanges instead of 15 per cent.

MICHIGAN COMMISSION

The report of the Michigan Railroad Commission on the telephone situation states that the system is overloaded with unnecessary calls which should be eliminated. This applies to each class of service. Party lines, used by 52 per cent of the subscribers, show many more calls per day than are normally allowed. The commission recommends a metered service.

Current News Notes

THE ELECTRIC WAY.—On the rear of his electric delivery wagons a prominent merchant in a Middle West city has had affixed the legend: "Goods Bought at Brown's Get Home Before You Do—The Electric Way."

* * *

WATER-POWER IN NATIONAL FORESTS.—The national forests of the United States contain waterfalls with an aggregate estimated capacity of 12,000,000 hp. These sites are available for use under permit from the Secretary of Agriculture at Washington.

* * *

MELTING POINTS OF COPPER ALLOYS.—"The Approximate Melting Points of Some Commercial Copper Alloys" is the subject of a report by Messrs. H. W. Gillett and A. B. Norton, which has just been issued as Technical Paper No. 60 of the United States Bureau of Mines. The director of the bureau, Washington, D. C., has copies for free distribution.

* * *

ELECTRICITY IN CALCUTTA.—The electrical engineers in Calcutta, India, have formed a local section of the Institution of Electrical Engineers, electing Mr. R. Winkfield its first chairman. The Calcutta Electric Supply Company at present has connected to its system over 40,000 fans, 370,000 lamps and 1096 motors, the latter varying from 1 hp to 250 hp in rating.

* * *

THE SOUTHERN CALIFORNIA EDISON SYSTEM.—The Southern California Edison Company, with headquarters at Los Angeles, operates seven water-power plants, three steam plants and fifty-one substations, supplying service over approximately 12,500 sq. miles of territory. Its transmission lines aggregate 822 miles in length, with a secondary distribution system totaling 1900 miles.

* * *

THE FIRST U. S. PATENT ON ICE-MAKING.—On exhibition at the National Museum, Washington, D. C., is the first patent for the artificial manufacture of ice granted by the United States government. It was issued as No. 8080 on May 6, 1851, to Mr. John Gorrie, of New Orleans, La. Both the papers accompanying the case and the patent itself are written by hand on parchment and are still in excellent condition.

* * *

VIA WIRELESS FROM TOGOLAND TO BERLIN.—The German government has prepared plans for the erection of a long-range wireless-telegraph station in Togoland, German West Africa, with sufficient power to have communication directly between Togoland and Berlin, thereby connecting Germany directly with all its African colonies. Other wireless stations have been and are now being constructed in Germany's other African colonies.

* * *

ELECTRIC "STAR OF HOPE" FOR NEW YORK PARK.—During Christmas week each year an electrically lighted 60-ft. Christmas tree is erected in Madison Square Park, New York City, to bring Christmas cheer to the city's homeless. To supplement this holiday feature, several unknown philanthropists have just had erected in the same park an electrically lighted star on a 30-ft. pole and have endowed this sign of hope for its operation during all the nights of the year, except when the electric Christmas tree is ablaze during the holidays.

* * *

A THIRTEEN-MILLION-DOLLAR WATER-POWER PLANT FOR SOUTHERN ITALY.—The Italian Parliament has passed an act authorizing the construction of a 150,000-hp hydroelectric development in Calabria, in southern Italy. The contemplated construction work will require the erection on a

grand scale of three dams at an estimated cost of some $13,000,000. In the aggregate it is expected to supply about 150,000 hp for traction, illumination and the development of industries, not only in Calabria, but also in Apulia and throughout southern Italy in general. Energy will also be employed on a large scale for irrigation purposes.

* * *

Municipal Plant Seeks Trained Manager.—The city of Owensboro, Ky., will shortly appoint a qualified engineer to act as city clerk and manager of the municipal electric-light and water plants. By combining the several offices and giving the consolidated position an adequate salary, the Mayor hopes to be able to get a man with sufficient technical training and executive ability to run the utilities on a modern and efficient basis.

* * *

Utah Power & Light Company a Trespasser on Forest Lands.—The United States Circuit Court of Appeals handed down a decision at St. Paul, Minn., Nov. 22, in the case of the government against the Utah Power & Light Company, of Logan, Utah. The court decided that the power company has no rights to land it occupies which is a part of the National Forest in Cache County, Utah. The decision, which reverses the District Court of Utah, in effect practically will make possible confiscation by the government of the greater part of the plant, in which $5,000,000 is said to be invested.

* * *

Ontario Hydroelectric Commission to Make Further Reductions in Rates.—According to the report of Mr. F. A. Gaby, chief engineer of the Hydro-Electric Power Commission of Ontario, the municipalities served by the hydroelectric system have been able to meet all obligations for operation and maintenance charges, including interest and sinking funds and to accumulate a balance available for depreciation and reserve accounts, without drawing on the ordinary tax receipts for deficits. This surplus ranged from 10 per cent to 56 per cent. There are now forty-six municipalities on the Niagara system, taking an aggregate of 52,000 hp. The Hon. Adam Beck, chairman of the commission, stated that further reductions in charges would be made next year, and that a formal announcement of these new rates will be made as soon as the municipalities have been consulted. In the cases of Toronto, Ottawa and London the commission has already prepared figures and will recommend that lower rates be made effective on Jan. 2. In Ottawa and London the present cash discount of 10 per cent on domestic and commercial lighting will be increased to 25 per cent, and a reduction of 18 per cent will be made in energy charges for motor circuits and for street lighting.

* * *

Prize Winners at Jobbers' Meeting.—At the November meeting of the Electrical Supply Jobbers' Association at Hot Springs, Va., Nov. 18 to 20 inclusive, field and indoor tournaments were provided. There was a golf tournament for manufacturers during the morning of Nov. 19 and a tournament for jobbers during the afternoon of the same day. On Nov. 18 and 19 there were pool and billiard tournaments, and during the afternoon and evening of Nov. 19 bridge and "five hundred" were played by the ladies. The following is the list of the prizes and winners: Manufacturers, golf—silver overlay water jug, Mr. Van Rensselaer Lansingh, Cleveland; golf bag, Mr. H. L. Everest, Jr., Chicago; silver overlay pitcher, Mr. R. F. Valentine, Cleveland. Jobbers, golf—silver overlay decanter, Mr. F. D. Van Winkle, Cincinnati; golf bag, Mr. F. B. Elliott, Philadelphia; cup, Mr. N. G. Harvey, Chicago; head lamp, Mr. L. V. Garron, Philadelphia; side lamps, Mr. F. P. Vose, Chicago; horn, Mr. G. B. Hill, Pittsburgh; vibrating horn, Mr. H. C. Lucas, Philadelphia; trouble finder, Mr. C. S. Walker, Indianapolis; tail-lamp, Mr. C. Scudder, Jr., St. Louis. Billiards—water pitcher, Mr. E. H. Haughton, Cleveland. Pool—water pitcher, Mr. H. F. Watson, Chicago. Ladies, bridge—cologne bottle, Mrs. H. S. Wilson, Philadelphia; tea samovar, Mrs. C. J. Litscher, Grand Rapids, Mich.; electric frying pan, Miss N. N. Sibley, Perth Amboy; electric frying pan, Mrs. E. K. Patton, Chicago; electric fan, Mrs. F. V. Burton, Bridgeport. Ladies, "five hundred"—electric percolator, Mrs. H. Hutchissen, Cleveland; toaster stove, Mrs. H. M. Savage, Boston; electric chafing dish, Mrs. F. M. Pierce, Chicago; electric fan, Mrs. R. Herstein, Memphis.

* * *

SOCIETY MEETINGS

Publicity for Electrical Congress.—Mr. Preston S. Millar, past-president of the Illuminating Engineering Society, has been appointed chairman of the committee on publicity of the International Electrical Congress to be held at San Francisco in September, 1915. Other members of the committee are Messrs. F. H. Gale, Schenectady, N. Y.; J. C. McQuiston, Pittsburgh, Pa.; A. H. Halloran, San Francisco, Cal., and O. H. Caldwell, New York.

* * *

Washington Section, A. I. E. E.—The Washington (D. C.) Section of the American Institute of Electrical Engineers held its first meeting of the season Nov. 11, when Mr. Norman Macbeth, editor of *The Lighting Journal*, made an address on "The Growing Recognition of Proper Lighting." Mr. H. C. Eddy, chairman of the section, and Mr. John H. Finney, past-chairman, were appointed members of a local committee to represent the Institute during the Conservation Congress held at Washington Nov. 18 to 20.

* * *

Ohio Society of Engineers.—The Ohio Society of Mechanical, Electrical and Steam Engineers held its eleventh annual meeting in Columbus on Nov. 20 and 21. About fifty members were in attendance. Among the papers and addresses was one by Mr. Francis C. Caldwell, professor of electrical engineering at Ohio State University, on "Quartz-Tube Mercury-Vapor Lamps," and another by Mr. George N. Lemmon on "Recent Developments in Electrical Transmission." The sessions of Nov. 21 were held at the Ohio State University, where the visitors were entertained at lunch and dinner.

* * *

Pittsburgh Section, I. E. S.—The Pittsburgh Section of the Illuminating Engineering Society will hold a joint meeting with the local section of the American Institute of Electrical Engineers, in the Auditorium, Oliver Building, Pittsburgh, Friday, Dec. 12. At this session the following papers are scheduled for presentation: "A Problem in Boulevard Lighting," by Mr. J. M. Froelich; "Variables in Street Lighting," by Mr. J. F. Martin, and "Some Aspects of Free Lamp Renewals," by Mr. Thomas F. Campbell. Mr. Alan Bright, 827 Wabash Building, is secretary of the Pittsburgh Section of the I. E. S.

* * *

Electrical Contractors' Association of Texas.—The state convention of the Electrical Contractors' Association of Texas was held at Waco, Tex., Nov. 13. Delegates from Dallas, Greenville, San Antonio, Fort Worth, Houston and Waco were in attendance. In the absence of President Martin Wright, of San Antonio, Vice-president Jack Owens, of Waco, presided. The following officers were elected: President, Mr. A. J. Anderson, Fort Worth; vice-president, Mr. W. H. Earle, Dallas; treasurer, Mr. George Bounds, Fort Worth; secretary, Mr. C. M. Cockrell, Dallas; director to national convention at Detroit in July, 1914, Mr. William Clower, Dallas; alternate, Mr. E. T. Bordeu, Houston. Fort Worth was selected as the place of the next convention April 25, 1914.

New Turbine Installation at Little Rock, Ark.

Station of the Merchants' Lighting Company built in six months, together with complete underground and overhead distribution system—Condenser pit to accommodate varying river stages

PRINCIPAL interest attaches to the new turbine station and distribution system of the Merchants' Lighting Company at Little Rock, Ark., as a result of the rapidity with which this 2500-kw plant was built.

The company was granted its lighting franchise June 3, 1912, but on the condition that the plant should be in operation by the same date on the following year. Owing to various delays actual construction was not begun until Nov. 15, 1912, but from that date on the work was pushed energetically, despite the serious handicap interposed by the rainy season which had meanwhile set in. By May 13, however—three weeks before the date scheduled in the franchise—both plant and distribution system were ready for operation and the complete installation has since been in regular service.

The power-house building is of pressed brick and rests upon the famous rock projecting into the Arkansas River, from which the city receives its name. This landmark is the first rock seen on the river trip from New Orleans up the Mississippi and thence up the Arkansas River to the city of Little Rock. The power-house building measures 114 ft. by 96 ft. in plan and is 45 ft. high.

The roof trusses in the boiler and turbine rooms are of the Howe type. A monitor roof extends down the center of the boiler house and is carried by two Fink trusses elevated 5 ft. above the main roof. The latter is of red tile and is covered with a layer of felt roofing, on which a tar-and-gravel coating is in turn laid. The boiler-house front is largely filled in with galvanized-steel sashes and wire-glass. Rolling steel curtains are to be installed beneath the wire-glass in the boiler-room panels.

STEAM-PLANT EQUIPMENT

The boiler equipment consists of three vertical-header Babcock & Wilcox boilers, carrying a working pressure of 200 lb. per sq. in. and equipped with forged-steel headers, nozzles and mud drums. Each boiler evaporates 10,700 lb. of water per hour from and at 212 deg. Fahr. The boilers are elevated 2 ft. above the standard setting, and the corner posts are placed outside of the brickwork so that stokers may be installed at a later date.

The stack was erected by the Weber Chimney Company and is of the latter's standard coniform type, 175 ft. high by 8 ft. 6 in. in diameter at the top. It is lined with an additional stack 50 ft. high, with an air space between the two stacks for expansion and contraction. The concrete mixture used consists of one part R. W. Hunt tested Portland cement, three parts clean, sharp, deep-water sand, and five parts of clean, sharp trap-rock passed through a 1-in. screen. Four galvanized-steel lightning rods, spaced 90 deg. apart, extend the height of the stack, projecting onto bedrock at the base and 5 ft. above the top. During a

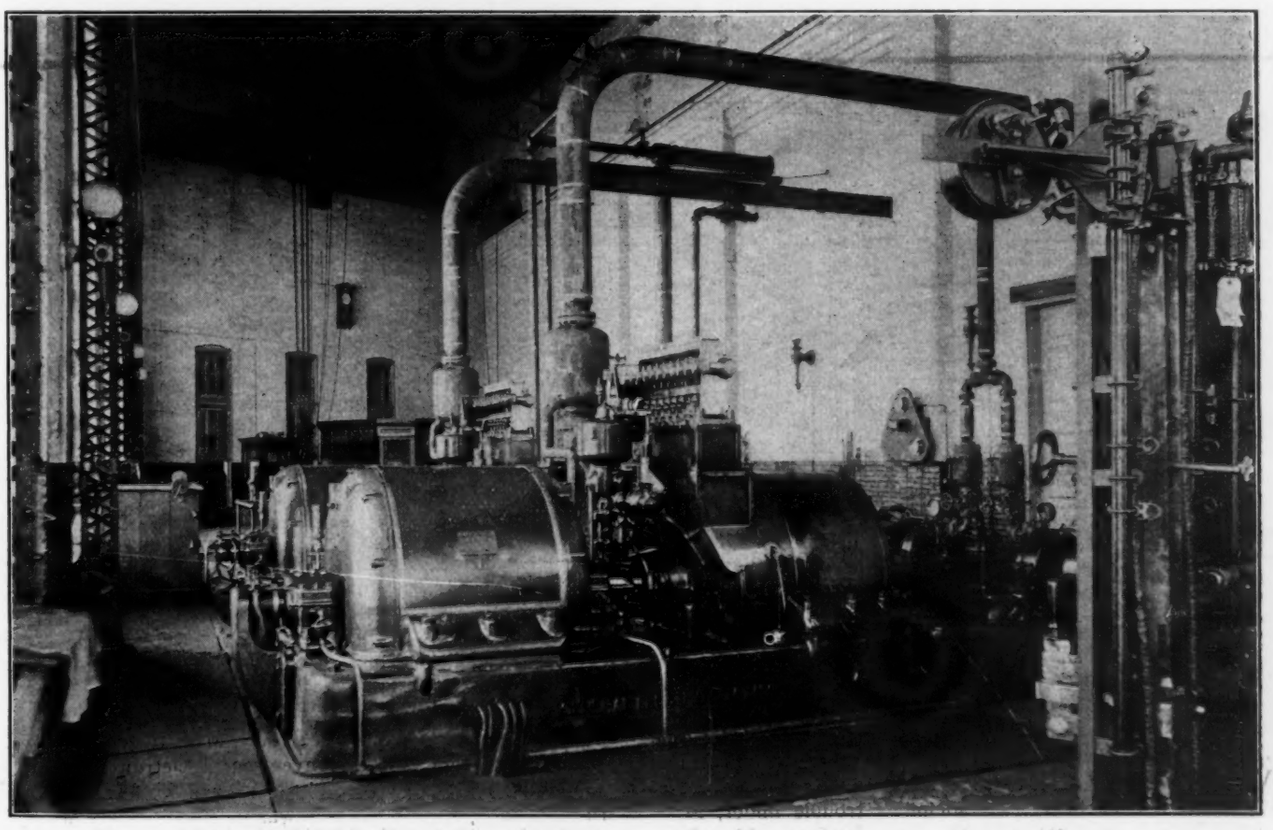


FIG. 1—TURBINE ROOM IN PLANT OF MERCHANTS' LIGHTING COMPANY, LITTLE ROCK, ARK.

recent thunderstorm lightning struck the stack, and except for momentarily illuminating the boiler house, close inspection has shown absolutely no damage at all, not even a chip being loosened from the top of the stack. The breeching is of No. 4 Birmingham gage iron and measures 11 ft. 6 in. high by 5 ft. 6 in. wide, with an expansion joint between each battery of boilers.

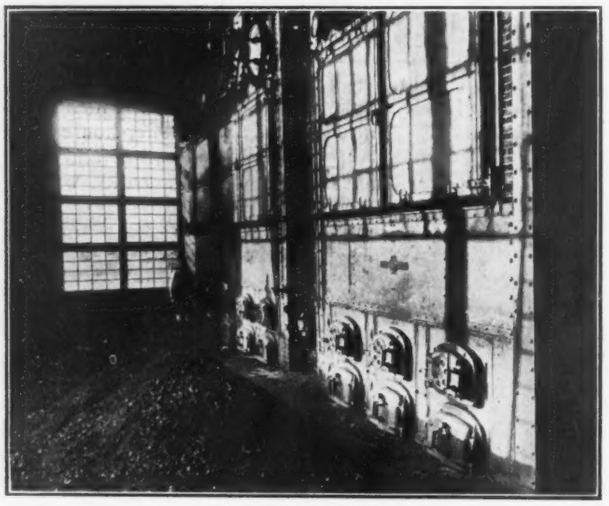


FIG. 2—INTERIOR OF BOILER ROOM

All three passes of the boilers are built of firebrick of the very best grade. There is additional room in the boiler house for two more units similar to those now in use. A traveling-pan ash conveyor made by the Webster Manufacturing Company, with dumps adjoining each boiler, cares for all ashes from the boiler house.

"Vigilant" boiler feed-water regulators are installed on each boiler, maintaining an even and constant water level. One 1200-hp Cochrane feed-water heater and purifier supplies the necessary heat to the feed water. At present the feed water is held at 212 deg. Fahr. The feed-water

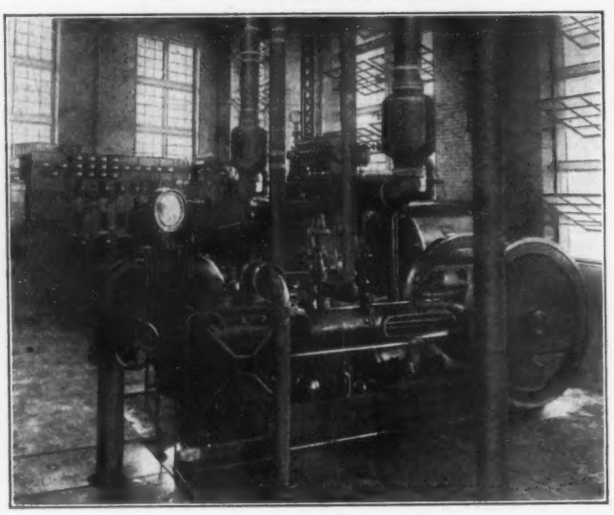


FIG. 3—ROTARY DRY-VACUUM PUMP IN TURBINE ROOM

heater is arranged with a by-pass so that it may be cleaned at all times.

Two outside, end-packed, double-acting, pot-valve Fairbanks-Morse boiler-feed pumps, each rated at 140 gal. per minute, supply the necessary boiler-feed water and are equipped with Fisher governors operating in connection with the Vigilant boiler feed-water regulators already mentioned.

Steam Piping

The steam piping consists of a 10-in. main steam header of extra-heavy Spellerized steel, with Van Stone joints and extra-heavy, spot-faced, rolled-steel flanges. The main steam header is supplied with steam from 8-in. lines from each boiler. In each boiler-supply line are located both a gate valve and an automatic stop-and-check valve. The main steam turbines are supplied through 6-in. lines from the main steam header.

Below the main steam header, and attached thereto at three points, is the auxiliary 4-in. header, made up of extra-heavy steel pipe and Van Stone joints, with extra-heavy, spot-faced, rolled-steel flanges.

In addition to this header, a drip header, tapped into every fitting, drains the condensate from the main steam header directly back to the boilers through a stop valve and a check valve tapped in ahead of the respective boiler blow-off valves. Homestead blow-off cocks, in connection with standard Babcock & Wilcox blow-off angle valves, are used. The boiler-feed lines are of extra-heavy steel pipe, with Van Stone flanges.

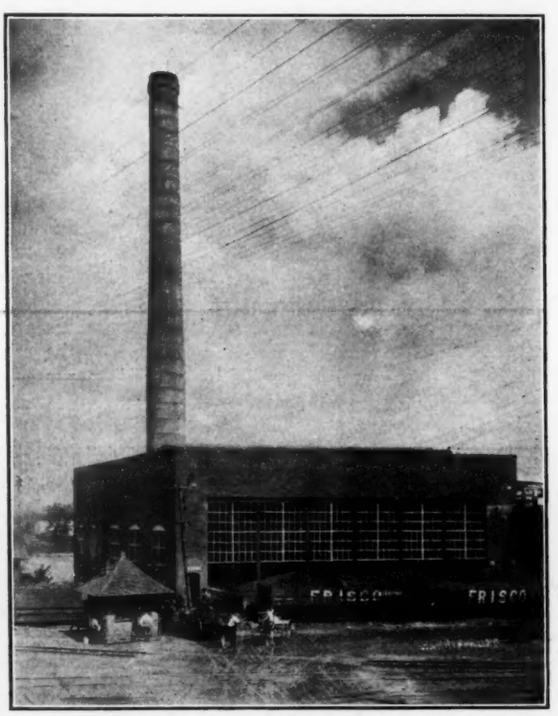


FIG. 4—PLANT EXTERIOR, SHOWING CONCRETE STACK AND LIGHTNING PROTECTION

The main exhaust line is of 30-in. steel pipe, with Van Stone joints and cast-iron flanges.

All valves larger than 2.5 in. have cast-steel bodies, bonnets and yokes, with monel-metal valves, seats and stems. All fittings such as ells, tees, separators, etc., are of cast steel. All valves and fittings 2.5 in. and smaller are of extra-heavy brass throughout. This high-grade piping was employed since it is planned shortly to install superheaters for 150 deg. superheat, which will require the very best metal. A Foster reducing valve reduces the boiler pressure on the auxiliary steam engines from 200 lb. to 150 lb. per sq. in.

All atmospheric exhaust piping from the main steam turbines and feed-water heater is of galvanized American spiral-riveted pipe, with Burt exhaust heads. Davis automatic atmospheric relief valves are installed in the atmospheric-exhaust lines from the main turbines. These lines are outside of the building and are sealed with heavy oil so that in cold weather no trouble will be experienced from frost. Filters are installed in the line supplying bearing

water to the main turbines, as much trouble has been experienced at Little Rock with the city supply.

All steam piping is covered with standard 85 per cent magnesia, bound in muslin, painted black and fixed with brass bands at 30-in. intervals. All hot-water lines are covered with standard air-cell magnesia covering similarly bound with brass bands. Steam lines are painted black, water lines gray, air lines blue, cylinder-oil lines green, and engine-oil lines red, so that the operators can make no mistake in the pipes.

CONDENSING EQUIPMENT

Steam from the main turbines is condensed by one 3300-sq. ft. two-pass Alberger surface condenser, which is piped to permit reversal of the circulating water. The cooling supply is taken directly from the Arkansas River through a 24-in. cast-iron flanged pipe line. A 16-in. cast-iron flanged siphon leg forms the return to the river, thus balancing the greater part of the static head. Double screens are employed at the entrance of the 24-in. suction line, and wherever circulating-water pipe lines change cross-section eccentric reducers are used so that no air pockets may form.

The condensers are supplied with water by two 10-in. Alberger double-suction horizontal, split-case volute pumps, with outboard, ring-oiled bearings, deep stuffing boxes and lantern glands. From the hot well condensed steam is taken by two two-stage turbine pumps to the fill-up tank in the boiler room. One hot-well pump is driven by a three-phase, 220-volt, 60-cycle General Electric motor running at 3600 r.p.m., and the other hot-well pump is operated by a Terry turbine. All condensing equipment is installed in a condenser pit located directly beneath the turbines and hewn out of the solid rock to a depth of 41 ft. 6 in. This pit provides for the 28-ft. rise and fall in the stages of the Arkansas River. All waste water from the glands in this pit drains to a sump located therein and is pumped out by an automatic 2-in. vertical Worthington volute pump directly connected to a 2-hp induction motor. All bearing water and other clean waste water is drained

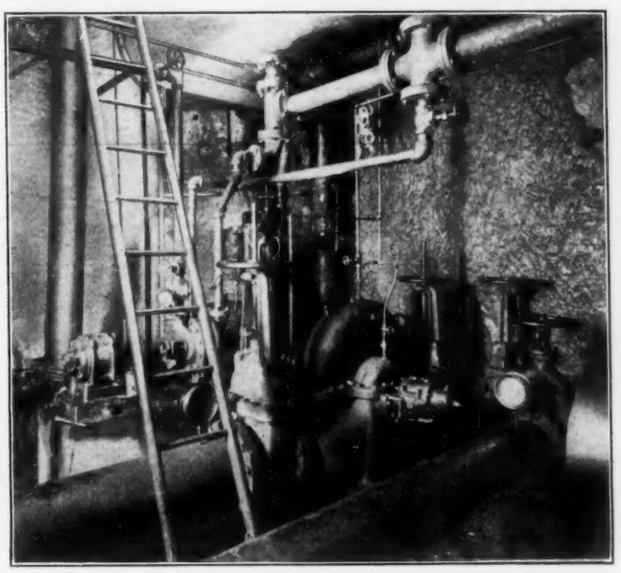


FIG. 5—CONDENSER EQUIPMENT IN PIT 41 FT. BELOW TURBINE FLOOR

to the bottom of this pit into a steel tank, from which it is pumped by one double-acting, single-cylinder, outside-packed Burnham steam pump controlled by a float from the tank water level.

Crane-tilt steam traps care for the condensate from the separators of the main and exciter turbines. Alberger rotary, dry-vacuum pumps are of the flywheel type, giving a full stroke, and are fitted with balanced valves. A vacuum of 28 in., measured with a mercury barometer, has been maintained throughout the summer months, which is an exceedingly good record considering the high temperature of the condensing water.

A 15-ton crane traverses the turbine room, and its main chain is long enough to permit the hook to be lowered 40 ft. below the turbine-room floor, so as to handle the condensing equipment in the pit easily when this is desired.

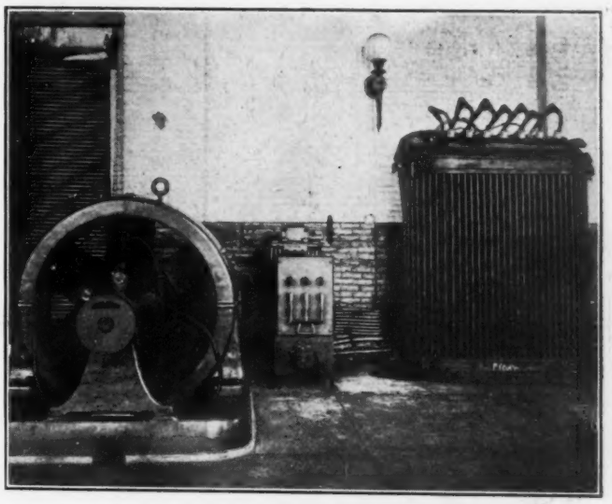


FIG. 6—TRANSFORMER AND SYNCHRONOUS CONVERTER

TURBINE ROOM

The turbine room is 114 ft. long by 35 ft. 6 in. wide and measures 42 ft. in height. The main units consist of two 1250-kva, 2300-volt, three-phase, 60-cycle, 3600-r.p.m. horizontal General Electric turbine-alternator sets. Exciting current is furnished by two 35-kw, 125-volt turbo-generators. These exciters are flat-compounded, so that, if desired at a later date, Tirrill regulators may be installed without further complications.

On the switchboard each of the two turbine panels is equipped with a voltmeter and eight-point plug, three ammeters, a direct-current field ammeter, a three-phase indicating wattmeter, a kilowatt-hour meter and an automatic oil switch with definite time-limit relay. Each exciter panel has an ammeter and voltmeter and the usual rheostats. The four three-phase feeder panels for light and motor service are equipped with automatic oil switches controlled by inverse time-limit relays.

Direct current for the system is supplied by 300-kw, three-phase, 60-cycle, three-wire, 500-volt General Electric rotary converters, arranged for 10 per cent boosting or lowering from the alternating-current side for direct-current voltage regulation.

DISTRIBUTING SYSTEM

The distributing system throughout the business district is entirely underground and has the distinction of being the first such system of its kind in Arkansas. The city of Little Rock is without storm sewers of adequate size to care for the drainage, and the result is that during heavy cloudbursts the downtown districts often become flooded, putting streets, alleys and sidewalks a foot under water. In order to keep its manholes and conduits dry, the Merchants' company constructed a main sewer of 8-in. salt-glazed vitrified clay pipe, with laterals of 6-in. similar pipe, under all conduits and manholes in the business district. This sewer system has a minimum drain of 6 in. for each 100 ft. Each manhole is trapped directly into the sewer with an ordinary P-trap and ball screen, and absolutely no water has been found in any manhole either during or immediately after the heaviest cloudbursts. The main sewer discharges into the Arkansas River directly at the rear of the power

house and in view of the turbine room so that the working of the sewer may be observed at all times.

All conduits are made up of units of three-hole or four-hole ducts with broken joints, while an envelope of concrete 4.5 in. thick entirely surrounds the finished conduit. Each joint has been wrapped with cheesecloth 6 in. wide, and all conduits were thoroughly scraped and mandreled

FIG. 7—ORNAMENTAL STREET LIGHTING IN UNDERGROUND DISTRICT

after completion. All ducts are of 3½-in. actual bore, and no duct was allowed to enter the work which showed the least irregularity, roughness, bend, crack or other defect. The manholes are square in cross-section, with a 6-in. reinforced-concrete roof, a 6-in. concrete floor and the walls built of vitrified paving block laid in cement mortar, making a thoroughly waterproof job. Manhole covers of a very heavy type are used. They are circular in form and have openings large enough to admit freely a 100-kva subway transformer. Nearly all manholes are 8 ft. by 8 ft. in cross-section, except in a few cases where very congested piping conditions were found. Here they were reduced to 6 ft. by 8 ft. in section. Six-foot head-room is allowed in all manholes. There are 104,000 duct-feet in the underground system, and the average cost, including sewers and manholes, was 22 cents per duct-foot. This is very reasonable, con-

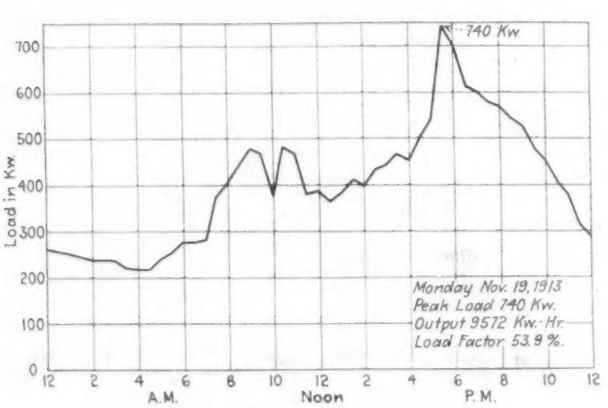


FIG. 8—TYPICAL LOAD CURVE

sidering the fact that sewer cuts 18 ft. deep through the city streets were met with in several instances.

System of Feeder Cables

The business district is divided into three sections, fed by three 2300-volt cables. These comprise one three-conductor, 250,000-circ. mil cable, one three-conductor 4/0 cable, and one three-conductor 2/0 cable. All are paper-insulated and lead-covered and have been tested for five minutes at 20,000 volts. The reason for requiring this high test pressure is that after the confines of the business district are passed, these cable circuits become aerial lines and danger exists of contact with the 10,000-volt series street-lighting circuits. For secondaries, three-conductor, paper-insulated, lead-covered cable made up of two 300,000-circ. mil and one No. 0 copper conductor is used. All secondaries in the respective districts are cut in without fuses to the transformers, and all transformers are banked.

Primary three-pole, three-way Johns-Manville junction boxes are used, with disconnecting switches and fuses, so that each transformer is fused and disconnecting switches may be replaced with line fuses, where needed, at proper intervals. The secondary junctions are three-conductor, four-way boxes, with disconnecting switches on the mains and transformers and with fuses in the feeders going out of the manhole. This construction permits any one business block to be cut out automatically in case of fire, without injuring or inconveniencing any other section.

Direct current is distributed through paper-insulated,

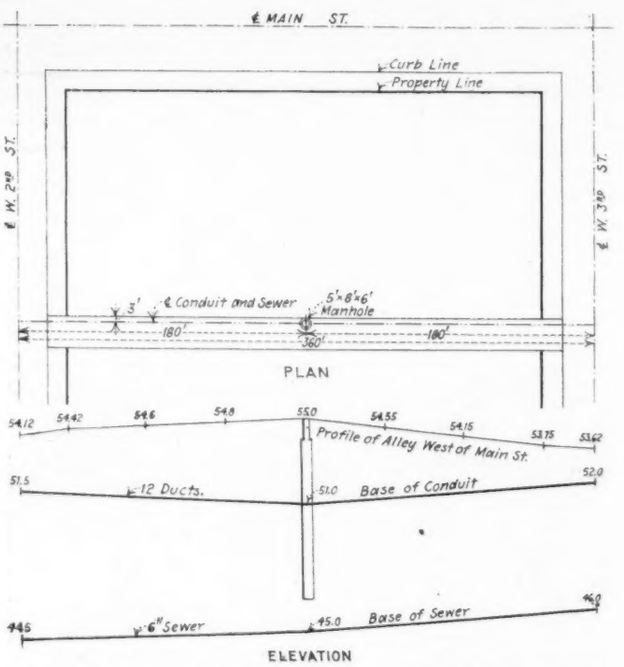


FIG. 9—UNDERGROUND CONDUIT AND SEWER CONSTRUCTION

lead-covered cables containing three conductors—two No. 2/0 wires and a No. 2 neutral. This cable has all been tested to 5000 volts. Three-way junction boxes are here used, the mains being three-pole and the branches two-pole, so that 250-volt direct current may be derived at each manhole for the operation of elevators, printing presses and other direct-current service.

Plant Efficiency Obtained

The station described has been operating since May 13, having been erected complete in the short space of six months. Considering the distance from the manufacturers and all sources of supply, in addition to the difficulties interposed by the rainy season, this construction feat was a very rapid piece of work.

During the month of August 215,000 kw-hr. were sold, with a maximum demand on the station of 420 kw and a load-factor of 74 per cent. The water rate of the station is 37.5 lb. of water per kilowatt-hour, with a coal consumption of 3.6 lb. per kilowatt-hour. Ordinary slack, running 13,400 lb.-Fahr. thermal units per lb., is used and costs $2.10 delivered in the company's bins. On Nov. 18 the con-

nected load consisted of 1423 hp in three-phase, 60-cycle motors, the equivalent of 27,514 50-watt alternating-current incandescent lamps, 94 hp in 220-volt direct-current motors, fifty-six 6.6 alternating-current series-arc lamps, eight 110-volt multiple-arc lamps and four General Electric flame-arc lamps.

With the large contracts recently closed, it will soon be

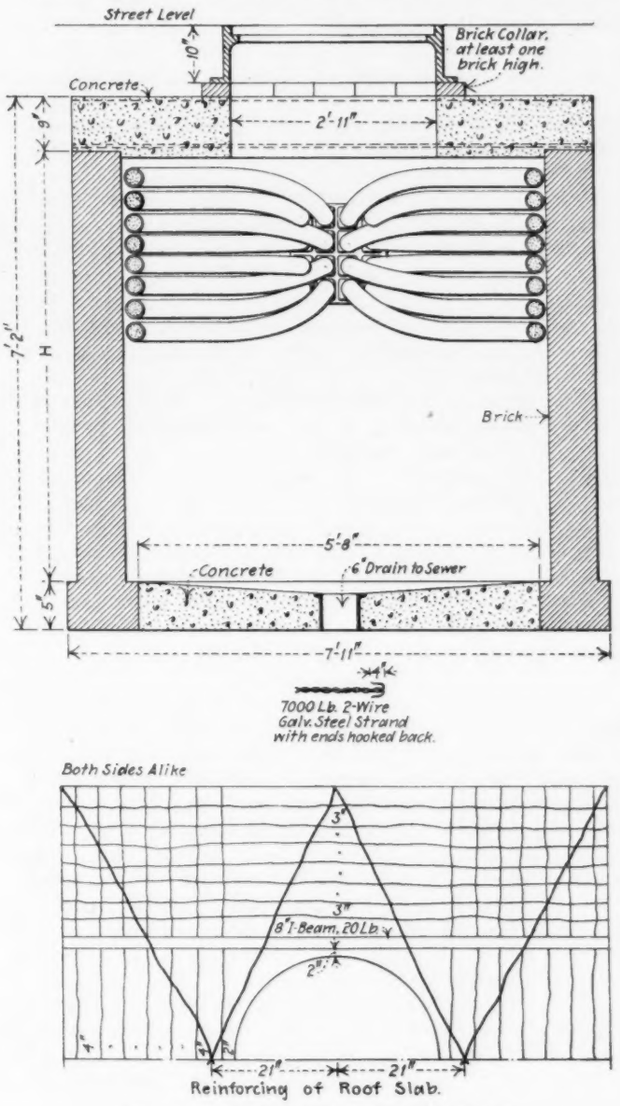


FIG. 10—CONSTRUCTION OF MANHOLES

necessary to install an additional 2500-kw turbine, besides an additional boiler, with chain-grate stokers and superheaters, to care for the company's rapidly growing business.

Among the recent activities of the Merchants' Lighting Company was the execution of a thirty-year contract with the city of Argenta (which is a community of 15,000 people directly across the Arkansas River from Little Rock), closing down the latter's 600-kw municipal plant, which formerly furnished all the municipal and practically all the commercial lighting in Argenta. The company has also contracted for replacing two 125-hp American-Diesel oil engines in the plant of the Arkansas Cold Storage Company with 300-hp induction motors. The maximum demand on the Argenta municipal plant last winter was 315 kw, with an output of 700,000 kw-hr. During the summer just closed the demand of the Arkansas Cold Storage Company was 240 kw, with a consumption of 850,000 kw-hr. for the year.

An accompanying illustration shows the ornamental tungsten lighting equipment operated by the company in the underground-distribution district. The top globe on each post contains a 100-watt tungsten lamp and the four lower spheres each one 60-watt unit. About sixty of these standards have been installed within the last four months.

The power plant of the Merchants' Lighting Company was designed and constructed by Mr. C. E. Rose, of Little Rock, who is now the general manager of the company.

Hydroelectric Project on Klamath River

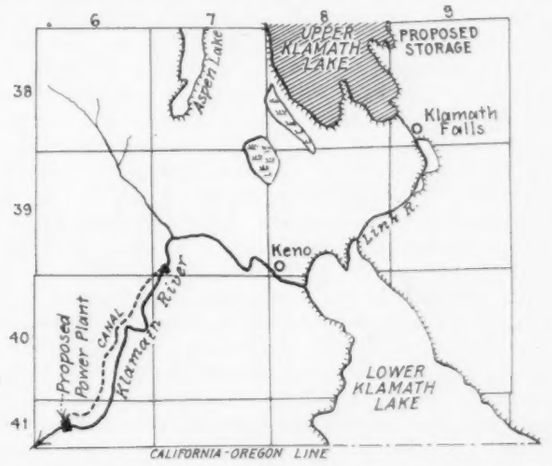
A large water-power project on the Klamath River below Keno, Ore., has recently been surveyed in a preliminary way by the State Engineer and the United States Reclamation Service under the provisions of the state law authorizing co-operation. This project is incidental to reclamation work in this region; and the investigation is being carried on from the fund of $100,000 now available.

A canal 10.5 miles long in Oregon, terminating about 2 miles above the California-Oregon boundary line, will afford a fall of 780 ft. With limited storage in Upper Klamath Lake 1200 cu. ft. of water per second can be relied upon during the dry season. This will furnish approximately 100,000 gross hp. As the prospects appear favorable for constructing a large reservoir near the lower end of the canal, the low-water output of this project will compare favorably with the famous Keokuk plant on the Mississippi River, which has only 20,000 cu. ft. of water per second at low stage with 39 ft. fall. While the canal will involve considerable rock and tunnel work, the preliminary estimate is $200,000 per mile, or $21 per horse-power for the cost of this feature.

The water necessary for this project has been withdrawn from entry under the provisions of law, and in conformity with the State's contract with the Secretary of the Interior. This withdrawal will not conflict with any of those projects now contemplated near Keno, and the water will be returned to the stream about a quarter mile above the intake of the proposed Shasta Valley Canal.

A preliminary report has been made with a view to irrigating a tract 24 miles in length by about 12 miles in width in Shasta Valley, Cal., by the storage of water in upper Klamath Lake, Ore.

The Southern Pacific Company is now building a large



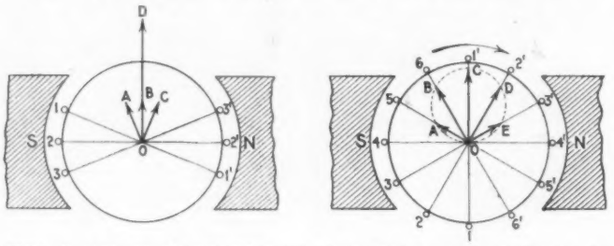
MAP SHOWING PROPOSED HYDROELECTRIC DEVELOPMENT IN OREGON

power plant on the Klamath River just over the line in California, which prevents the Shasta Valley people from diverting the regular flow of this stream. The water-right situation is thus quite complicated and can only be adjudicated by the closest co-operation between the two states and the nation, or under some federal law paramount to the rights of the individual state in case of disagreement.

Armature Mmf Relations in Synchronous Machines

Simplified graphical treatment of the effect of single-phase and polyphase armature ampere turns on the field magnetism. By J. H. Morecroft

THE magnetic effect of an alternating current flowing through a revolving coil is not easy to picture to one's self, and yet the effect of the armature magnetomotive force on the main magnetic field of a machine is very important, and one must understand it fully before he has mastered the theory of alternating-current machinery. Below is given a simple explanation of the



FIGS. 1 AND 2—VARIATION IN MAGNITUDE AND POSITION OF MMF IN SINGLE-PHASE ARMATURE AT UNITY POWER-FACTOR

effect which seems to be a new way of looking at the matter. It is possible that other writers have used this idea, but the present writer does not remember having seen it stated anywhere.

The single-phase alternator will be first considered. The premise on which a start is made is that a group of coils (such as are found on the armature of alternating-current machines) produce practically the same magnetic effect as a properly placed single coil carrying a suitable current, for example, the elementary single-phase alternator shown in Fig. 1.

It is assumed that there are three coils, 1-1′, 2-2′ 3-3′, making up the single-phase winding so that these three coils are connected in series and hence carry the same current. The magnetic effect (at *O*) of these three coils may be duplicated by a winding of only one coil carrying about three times as much current as that carried by coils 1-1′, etc. In Fig. 1 the mmfs of the three separate coils are shown by *OA*, *OB* and *OC*; the resultant mmf of the three is evidently *OD*, which is in the same direction as *OB* and nearly three times as large. It is evident that the mmf *OD* could be produced by coil 2-2′ acting alone, provided it carried enough current.

Hence the single-phase winding shown in Fig. 1 could be sufficiently well represented by a winding of only one turn (in the plane of coil 2-2′), which turn carries enough current to give about the same number of ampere-turns as does the actual winding. Similarly, a two-phase winding may be represented by a two-coil winding and a three-phase winding by a three-coil winding.

Considering the mmf of a single-coil armature carrying current in time-phase with its generated emf. The various positions this coil assumes as it revolves are shown by 1-1′, 2-2′, 3-3′, etc., of Fig. 2. At 1-1′ no emf is generated, and hence there is no current and the coil produces no mmf. At 2-2′ the current has some small value and the mmf of the coil is proportional to this value and is perpendicular to the plane of the coil 2-2′; it is shown by the vector *OA*. As the coil moves around the current increases and so does the mmf; this is a maximum (shown at *OC*) when the coil has the position 4-4′. As the coil moves farther the current starts to diminish, so that at position 5-5′ the mmf is given by the vector *OD*, etc.

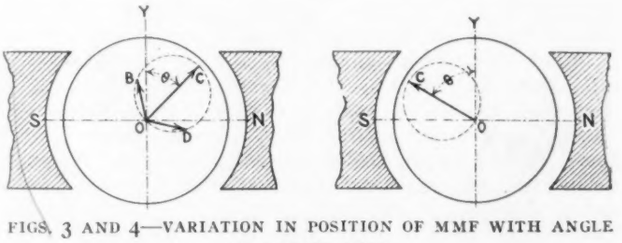
It is known that in an ordinary alternator the form of the current curve is given by the equation $i = I_m \sin \omega t$, where ω is the angle through which the coil has revolved from its zero position, 1-1′. If now the mmf vectors are carefully plotted, it will be found that they lie on a circular locus as shown by the dotted circle of Fig. 2. As the coil revolves, its mmf vector continually passes over the same locus.

An examination of the form of this locus shows that for nearly all positions the coil has a magnetizing or demagnetizing effect combined with a cross-magnetizing effect. For example, in position 2-2′ the armature coil is magnetizing the main field and also cross-magnetizing it. In position 4-4′ the effect is entirely a cross-magnetizing effect, and in position 1-1′ no mmf is produced by this coil. When the coil has revolved 180 deg. (electrical space) the main field has been first strengthened and then weakened (a complete cycle of change in field strength), and it has been distorted from its normal position a maximum and has returned to its normal position.

Therefore a complete cycle of field changes occurs while the coil revolves 180 deg.; hence when the coil has revolved 360 deg. (thereby generating one complete cycle of emf) the main field has been through two complete cycles of change in strength and position. Thus a search coil placed on the pole of a single-phase alternator shows an induced emf of a frequency equal to twice that of the armature emf. This double frequency emf in the search coil is produced by the single-phase armature reaction. Its magnitude depends upon the magnetic leakage between the field and the armature and upon the ratio of armature ampere-turns to field ampere-turns.

Hence in a single-phase alternator the armature reaction results in a pulsating strength and varying position of the main field. This action produces excessive heating in the pole faces, due to eddy currents and hysteresis in the material of which the pole is composed.

Although not a part of this discussion, it is interesting to note that the changes in field strength due to armature



FIGS. 3 AND 4—VARIATION IN POSITION OF MMF WITH ANGLE OF LAG OR LEAD

reaction result in the generation of higher frequency emfs in the armature. For example, suppose a revolving-armature, single-phase alternator in which, when the main field is constant, an emf of 60 cycles is generated in the armature. As soon as current exists in the armature the armature reaction produces a variation in the main field of $2 \times 60 = 120$ cycles per second. Now, this 120-cycle

field will produce in the armature (revolving with a speed of 60 cycles) $120 + 60 = 180$ cycles per second. Hence the armature and main field of a single-phase alternator continually react on one another, resulting in the generation of very high frequency emfs, although the armature has a comparatively low rotative speed. One of the well-known high-frequency alternators (used in wireless telegraphy) operates upon the principle of utilizing this effect of armature reaction.

When the armature current and generated emf are in time-phase with one another it is evident (by inspection of Fig. 2) that the main field suffers no *net* magnetizing or demagnetizing action. While the coil moves from position 1-1′ to position 4-4′ the field is being magnetized by the armature current, but when it moves from 4-4′ to 1′-1 the field is being demagnetized. Neglecting the variability in permeability of the magnetic circuit as the flux density changes, the net effect on the average strength of the field is zero.

When the armature current lags behind the generated voltage the shape of the armature mmf locus is the same as before, but the circle is moved into some such position as shown by Fig. 3. The maximum mmf OC occurs after the coil has passed the center of the pole faces by an angle equal to θ, where θ is the phase difference of the emf and current in the armature. An inspection of Fig. 3 will show that the armature will actually demagnetize the field in this case. Two mmf vectors symmetrically placed with respect to the diameter of the circle, such as OB and OD, neutralize one another in Fig. 1 in so far as their magnetizing and demagnetizing components are concerned, but in Fig. 3 this is not so. The demagnetizing effect of OD is much greater than the magnetizing effect of OB, and any other pair of symmetrically placed mmf vectors yield the same result.

Hence with a lagging current the single-phase alternator has a field which not only pulsates in strength and position but also decreases in average strength as the load increases. The amount of distortion of the field from its normal position is less than when $\theta = 0$, but the shift takes place on both sides of the normal position, whereas when

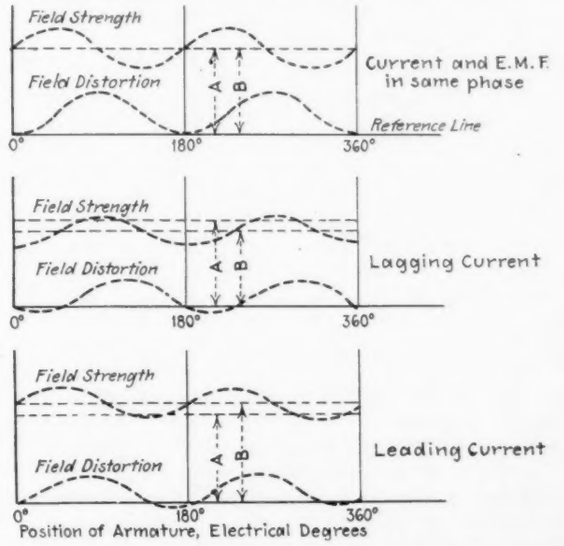
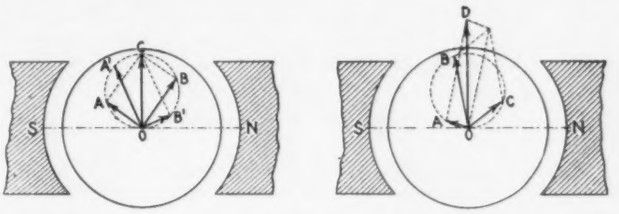


FIG. 5—EFFECT OF ARMATURE MMF ON FIELD STRENGTH

$\theta = 0$, the field is distorted only in the direction of rotation of the armature.

When a leading current exists in the armature the circular locus of armature mmf is moved backward as shown in Fig. 4. In this case the effect of armature mmf is to strengthen the field as well as to distort it. The effect of the armature mmf on the field strength in the three cases is shown by curves in Fig. 5. In these curves A represents the strength of the field at no load, due to field mmf only. B is the average strength of the field at full load. Positions of the "field distortion" curve above the reference line indicate a twist in the field in the same direction as that in which the armature rotates, and positions below the reference line signify twist opposite to the armature rotation.

The magnitude of the distortions and pulsations shown



FIGS. 6 AND 7—MMF RELATIONS IN TWO-PHASE ARMATURE

in Fig. 5 depends directly upon the load the machine is carrying. When $\theta = 90$ deg. (a condition which is approximated when the armature of an alternator is short-circuited) the ratio of $(A - B)$ to A is determined by the ratio of armature ampere-turns and field ampere-turns.

Consider now a two-phase armature (carrying a balanced, non-inductive load) on which are wound two single coils at right angles (electrical space) to each other. Each coil will act in exactly the same manner as described for the single-phase alternator. The mmf locus for both coils will be the same circle, and at any instant there is acting on the main field a mmf which is the resultant of two chords of the circle separated from each other by 90 deg. The result is shown in Fig. 6. Consider that at the first instant phase 1 is producing a mmf OA and phase 2 has a mmf OB; the resultant of these two is OC, and the diameter of the circle. An instant later phase 1 has a mmf OA' and phase 2 a mmf OB'; the resultant is again OC. Now, no matter what position of the armature is considered, it will be found that the resultant mmf is OC. Hence it is seen that the armature of a balanced two-phase generator produces a mmf which remains constant in magnitude and stationary in space as the armature revolves.

Neglecting the correction factor (required when the actual distributed winding of a phase is supposedly replaced by a single coil carrying suitable current), it is evident that the magnitude of the armature mmf of a two-phase machine (in ampere-turns) is equal to the number of turns per phase multiplied by the maximum value of the current in either phase.

The position of the armature mmf (with respect to the main field) depends entirely upon the angle of time-phase difference between the current and the generated emf. When the load is non-inductive the mmf vector is perpendicular to the main field (as in Fig. 6) and the only effect of the armature mmf is to distort the main field. It may indirectly weaken the field somewhat owing to the crowding of the magnetic flux in to the trailing pole-tips, resulting in decreased permeability of the pole. If the load draws a lagging current from the armature, the mmf vector OC is shifted in the direction of the armature rotation, resulting in a direct demagnetizing action by the armature, as in the case of a continuous-current generator with brushes shifted forward.

In case the armature carries a condensive load the armature mmf vector is shifted against the direction of rotation, thereby resulting in a strengthening of the main field by the armature mmf as well as the distortion in the same direction as that in which the armature is rotating.

For a three-phase generator consider an armature on which are three coils at 120 space-degrees to each other. Each of these three coils has the same effect as that described for a single-phase armature, and at any instant the total armature mmf is obtained by adding three vectors on

circular locus, 60 deg. apart. Such a construction when carried out (Fig. 7) shows that in the three-phase alternator, as in the two-phase machine, the armature mmf is constant.

In magnitude the mmf vector is 50 per cent greater than that for a two-phase machine having the same number of turns per phase and carrying the same current per phase. This relation may be shown either analytically or graphically. In Fig. 7 the length of the vector *OD*, which is the resultant of *OA*, *OB* and *OC* (which are 60 deg. apart), is 50 per cent greater than the diameter of the mmf circular locus. No matter where the three vectors *OA*, *OB* and *OC* are taken, provided they are 60 deg. apart, their resultant is the same, namely, *OD*.

The position of the resultant armature mmf vector depends here also upon the angle between the generated voltage and the armature current.

If I is the current per phase in the balanced polyphase armature, in effective value, N is the number of turns per phase, and k is the reduction factor (required for changing the effect of the distributed winding to that of a concentrated winding), then in the two-phase machine

$$\text{Armature mmf} = 0.4\pi\sqrt{2}INk$$

For the three-phase machine

$$\text{Armature mmf} = 1.5(0.4\pi\sqrt{2}INk)$$

In either case the mmf may be divided into its two components by multiplying by sin θ or cos θ.

Hysteresis and Eddy-Current Losses in Transmission Towers

In connection with the design of 5200 transmission-line towers for the Pacific Light & Power Corporation, of Los Angeles, Cal., by the Stone & Webster Engineering Corporation, Boston, Mass., the preliminary calculations indicated possibility of hysteresis and eddy-current losses which deserved experimental study. The electrical engineering department of the Massachusetts Institute of Technology was requested to make an investigation of the magnitude of these losses, and the work was completed last summer by Messrs Oscar M. Arnold and Henry C. Harrison under the general direction of Dr. Harold Pender. As was anticipated, the losses were found to be exceedingly small, varying on test at 200 amp, the normal full-load current of the line, from 18 watts per tower at 25 cycles to 28.8 watts at 60 cycles. In view of the special design of tower

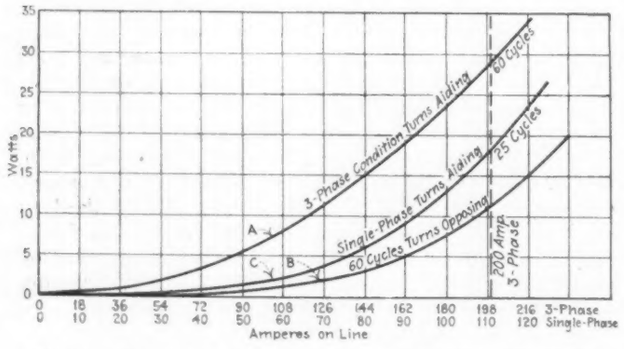


FIG. 1—WATTS LOST IN HYSTERESIS AND EDDY CURRENTS

employed and the method of testing these losses upon a typical tower structure at Boston, an outline of the work performed is of much interest.

The transmission lines will extend from Big Creek, near Fresno, to Los Angeles, a distance of about 240 miles. Three lines will be erected, each being designed to carry 4500 kva at 150,000 volts, the frequency being 50 cycles. The towers are of uniform dimensions, spaced from 600 ft. to 700 ft. apart. Each line conductor consists of a seven-stranded steel core surrounded by thirty aluminum strands giving a total diameter of 0.95 in. Nine-disk to eleven-disk strings of suspension insulators are employed. The towers differ from the usual design in the method of supporting the middle wire of the three-phase system, which is carried through the center of the structure as indicated in the accompanying diagram.

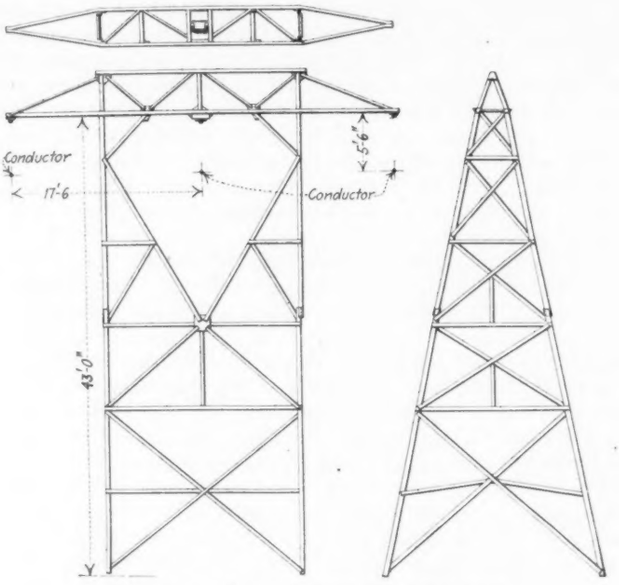


FIG. 2—STANDARD TOWER CONSTRUCTION

The towers each consist of a rectangular pyramidal frame carrying a line-supporting truss at the top, the truss extending at right angles to the direction of the line and having its bottom chord 43 ft. above the ground. The line conductors are hung 5½ ft. below the truss and are about 17.5 ft. apart in a horizontal plane. To enable the tests to be made at Boston the Stone & Webster Engineering Corporation erected such a tower on a vacant lot near the Institute laboratories.

As three-phase energy of the desired current and voltage was not available, single-phase current was used in testing. To approximate three-phase conditions the line was run down one side of the tower, back through the center, down the other side and back through the center. The connections were arranged to permit varying the ampere-turns around the tower. A double-throw switch connected the line either to a storage battery or to the low-tension side of a potential transformer. The high-tension side of the transformer could be connected to 25-cycle or 60-cycle mains. A second double-throw switch between the instruments and the source of power reversed the current in the line and instrument current coils, thus eliminating errors from stray fields. The accompanying diagram illustrates the scheme of connections. The wattmeter used was of the electro-dynamometer type with an ironless magnetic field and large current coils specially wound for these tests. All readings were taken with the moving coil in the same position, the reading being by the zero deflection method.

Tests were made of the loss in the line with direct current and with 60-cycle and 25-cycle alternating current with the turns through the tower both added and opposing. The loss measured was the total loss in the line from the laboratory building plus all tower losses. There was no iron or steel structure near the line to introduce external hysteresis or eddy-current losses. The total drop in the line was 5 volts, the line being carefully insulated and the tests run only on dry days to render leakage losses inappreciable. Before conducting the tests the wattmeter was adjusted so that the closing of the potential circuit caused no deflection,

thus eliminating the effect of the earth's field. Braided lamp cord was used for potential leads, to obviate leakage and inductive errors at this point. The standard runs were made as follows:

The lines were connected to the storage batteries and the current adjusted to a constant value. One observer held the current at this value while a second read the wattmeter, the direct-reading ammeter and the direct-current

SUMMARY OF TOWER LOSSES

Amperes, Three-Phase Current	Watts Loss in Tower at	
	60 Cycles	25 Cycles
50	1.8	0.4
100	5.9	1.8
150	16.1	6.8
200	28.8	18.0

and alternating-current voltmeters. The current was then reversed, adjusted to the previous value and held constant for another set of readings. The line was then connected to the 60-cycle circuit, the current adjusted to the former value and held constant for a third set of readings. After this the line was again connected to a direct-current supply, the current adjusted to a new value and the former procedure repeated. After the tests all instruments were carefully calibrated with a potentiometer. The magnetization curve of the tower was obtained by winding an explor-

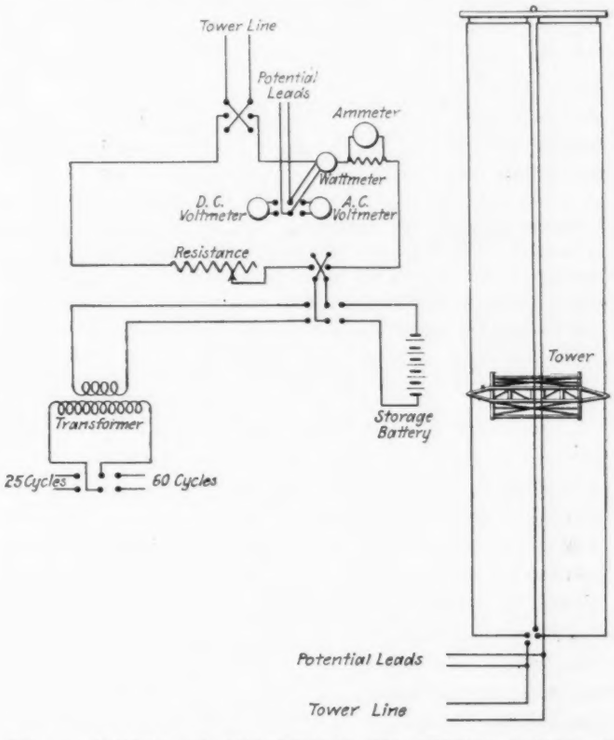


FIG. 3—SCHEME OF CONNECTIONS FOR TESTING LOSSES IN TOWERS

ing coil of ten turns around the frame at a point near the cross-arm and connecting in series with the test coil an air-core solenoid and a ballistic galvanometer. The galvanometer was calibrated by passing current through the line, suddenly reversing the current and reading both the line current and the galvanometer needle deflection. It was found by calculation that skin effect in the conductors as run through the tower was negligible.

RESULTS OF TESTS

The final results of the tests are shown in the accompanying curves and are taken from the difference of the average measurements of the power input with direct current and alternating current under the various conditions. Curve A shows the tower loss with 60-cycle current and the turns aiding, this being the maximum loss. Curve B shows the loss with 60-cycle current and turns opposing.

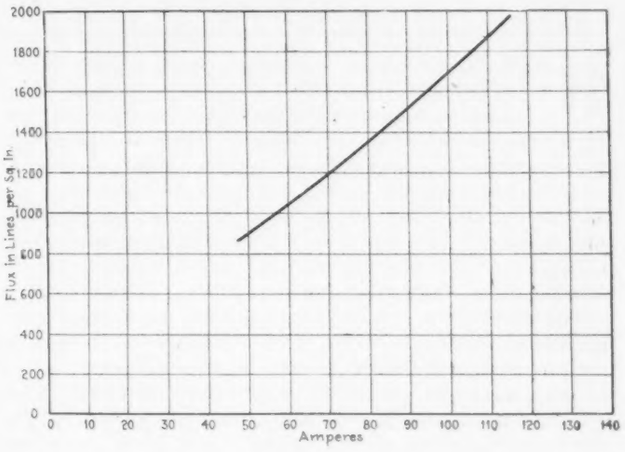


FIG. 4—TOWER MAGNETIZATION CURVE

Curve C is with 25 cycles and the turns aiding, the loss with turns opposing at this frequency being too small for measurement. With the total loss in the circuit measured to a precision of 0.4 per cent, the loss in the tower is known to about 4 per cent. The magnetization curve of the tower is also shown, the abscissas representing the line current measured and the ordinates the total lines of flux passing through the exploring coil. A large part of the magnetic circuit was air, but the reluctance of the air circuit is so large, compared with that of the steel circuit, that it was assumed that all the lines of flux pass through the steel members included in the exploring coil. With the effective three-phase current at 100 amp the permeability was tested and found to be 935, the field intensity being 0.286 lines per sq. cm.

A brief summary of the results is given in the accompanying table. On this basis the maximum tower loss in the three lines at 60 cycles would be 149 kw, or only 0.124 per cent of the total power transmitted. The actual system frequency is 50 cycles, which would reduce this under actual operating conditions. The tests indicate that the energy loss in the towers is more than offset by the advanvantages gained through their mechanical construction.

Extensions to Edison "Soo" Plant

The Edison Sault Electric Company's water-power plant in the rapids at Sault Ste. Marie, Mich., a station which has figured in interesting government condemnation proceedings, is now being extended to the limit line of the future American locks, so that by replacing with larger units the four 450-kw generators now installed space will be provided for six 750-kw turbine sets. When the new extension is made a 750-kw alternating-current generator directly connected to an Allis-Chalmers vertical water turbine will be installed. The turbine unit will be rated at 900 maximum hp and 100 r.p.m., and the generator will operate in synchronism with the 4000-2300-volt machines now installed. Next spring changes are contemplated in the arrangement of the switching equipment. Energy from this station is furnished to the city of Sault Ste. Marie and to the government for operating the locks.

Central-Station Energy for Chicago Railways

Terms of the contracts between the Commonwealth Edison Company and the surface and elevated lines of Chicago—Economies effected in investment, generating, transmission, distribution and operating costs

REVISED contracts, covering energy supply during the remaining life of the Chicago railway companies' franchises, have just been executed between the Commonwealth Edison Company on the one hand and the companies operating the elevated and surface railways of Chicago on the other. Under these contracts, as a result of the more efficient use of generating and distributing equipment provided for, energy will be furnished to net a lower price than before while at the same time more reliable service will be given.

The Commonwealth Edison Company has consistently maintained the position that it is uneconomical to supply the various energy needs of the same territory by means of more than one system of electrical transmission. For several years past the company has supplied all of the energy requirements of the Chicago City Railway surface system and part of those of the Chicago Railways (surface) and of the elevated railways. The railway portion of the output of the Edison company's power plants has thus rapidly increased until it is now 70 per cent of the total. These plants have been enlarged to care for the increased demand, while the few existing railway generating stations are being gradually put out of commission.

The Edison company has been supplying 25-cycle, three-phase energy at 900 volts pressure to substations owned and operated by the railway companies. In addition, it has operated substations in the same territory, transforming the high-voltage, three-phase alternating current into 4000-volt, three-phase form for distribution by the four-wire system, and to 2300 volts, single-phase, for distribution to lighting and industrial power circuits. The latter substations have been connected with the power plants by underground cables entirely distinct from the railway cables. The surface railway lines have also required transmission lines and substations separate from those of the elevated lines.

Results of Present Duplication

The results of this duplication have been several. In the first place, an excessive number of expensive substations have been required. Second, and possibly more important, the load-factor of the cables has been low and the cost of cables and conduit correspondingly large. Third, the unnecessarily large number of cables has increased the tendency to electrolysis.

The new contracts, as their terms given in some detail in the following paragraphs will show, remove the necessity for this duplication. They are modifications of the contracts under which the railways have been operating for some years and have been framed not only with a view to greater efficiency under existing conditions but to provide the city with possible management by the city or its lessee. It is assumed further that at any time the steam railways having terminals in Chicago may electrify them and may desire to purchase energy from the lighting company. Hence the articles of the contracts are carefully worded to permit the company to use its generating and distributing equipment for all of these purposes if able to offer satisfactory prices for energy.

The first part of the amended contract with the Chicago Railways Company is taken up with a definition of the maximum demand which the Commonwealth Edison Company may be called upon to supply. As in the old contract, this maximum demand for any month is calculated from the heaviest hourly morning and evening loads on three consecutive days so selected as to yield a total energy consumption for the six hours greater than would be obtained as the total of the corresponding six hours on any other three consecutive days. The Edison company must be ready to supply a maximum demand of 20,000 kw or one equal to that established by the loads of previous months if they exceed 20,000 kw. To provide for the extra power required for heating cars in extremely cold weather, the "emergency energy" consumed when the temperature of the air is at or below 15 deg. Fahr. is excluded in determining the maximum demand.

The second part of the contract covers the scale of prices for energy. This, as before, is made up of two parts, but a sliding scale is provided for both primary and secondary charges. These are shown in Tables I and II.

TABLE I—PRIMARY OR POWER CHARGE

Maximum Demand	Primary Charge per Kw
First 30,000 kw	$1.25
30,000 to 60,000 kw	1.00
60,000 to 90,000 kw	0.917
90,000 to 120,000 kw	0.875
Above 120,000 kw	0.833

These charges are subject to a correction for the price of coal. If during any two-year period the price of coal having a heating value equivalent to that of coal from mines in Central Illinois delivered at the storage yards of the Edison Company exceeds on the average $1.90 per ton,

TABLE II—SECONDARY OR ENERGY CHARGES

Monthly Energy Consumption	Charge per Kw-hr. in Fractions of a Cent
First 5,000,000 kw-hr	0.400
5,000,000 to 10,000,000 kw-hr	0.395
10,000,000 to 15,000,000 kw-hr	0.390
15,000,000 to 20,000,000 kw-hr	0.385
20,000,000 to 25,000,000 kw-hr	0.380
25,000,000 to 30,000,000 kw-hr	0.375
30,000,000 to 35,000,000 kw-hr	0.370
35,000,000 to 40,000,000 kw-hr	0.365
Over 40,000,000 kw-hr	0.360

the railway company shall pay an extra charge to cover this excess. The correction in dollars is obtained by dividing by 1000 the number of kilowatt-hours delivered during the two-year period and multiplying this by the excess price of the coal. This calculation is obviously made on the basis of a payment by the railway company of 2 lb. of coal per kw-hr. That is:

$$\text{Excess cost of coal} = \frac{2 \times \text{kw-hr.}}{2000} \times \text{cost} - \$1.90.$$

On the other hand, if the cost of the coal is less than $1.40, the electric company is to pay to the railway company a sum calculated as described.

TRANSMISSION AND DISTRIBUTION ECONOMIES

As so far described the new contract differs only in detail from its predecessor. The next feature, however, is designed to effect transmission and distribution economies and involves the joint use of substations by the two companies or the erection of substations by the lighting company alone. As at present, the railway company will own and operate at least a part of the required substations, but if there is in these ample space for the equipment required by the lighting company for its lighting or other business such equipment may be installed under terms mutually agreed upon. This equipment may include rotary converters for 600-volt service, and the Edison company agrees that if it has available capacity in the transforming equipment it will sell direct-current energy to the railway company for use in the vicinity of the substations. The Edison company further agrees to install substations where needed or required and to sell direct-current energy under the same general terms as alternating-current energy, with an additional charge for conversion and for a share of the cost of maintaining the substation based upon the proportion of its output used by the railway company.

The advantages gained by the new arrangement are partly these: From one substation it will be possible to supply service for all purposes, including railway energy for different companies occupying the same territory. For example, the elevated and the surface roads which now have separate systems of substations can be supplied from one system, thus greatly reducing the number of substations required. A reduction in number of substations renders the transmission systems simpler and thus more reliable and at the same time cuts down the transmission cost.

The railway company has agreed to generate no electrical energy during the period from Nov. 1, 1914, to Jan. 31, 1924, but reserves the right to do so after that date. In resuming generation, however, it is provided that Edison service shall be used in such amount as shall insure an average monthly load equal to 35 per cent of the amount which the lighting company must, under the contract, stand ready to supply.

The new contract differs from the old one in that the energy will be metered in alternating-current form at the high-tension terminals of the transformers in cases where the railway company operates the rotary converters, and otherwise at the points where service is delivered to the direct-current feeders.

PROVISIONS IN EVENT OF CONSOLIDATION

Looking forward to a possible consolidation of the railway systems of the city, the contract provides a new maximum scale of charges for use in such a contingency. These are similar to the ones already tabulated except that the rates apply to different ranges of consumption as follows: Primary charge, $1.25 per kw. up to 75,000 kw; $1, excess to 150,000 kw; $0.91, excess to 225,000 kw; $0.875, excess to 300,000 kw; $0.833, excess above 300,000 kw. The accompanying secondary charges are 0.4 cent up to 12,500,000 kw-hr. per month; 0.395 cent for excess to 25,000,000 kw-hr.; 0.390 cent for excess to 37,500,000 kw-hr.; 0.385 cent for excess to 50,000,000 kw-hr.; 0.380 cent for excess to 62,500,000 kw-hr.; 0.375 cent for excess to 62,500,000 kw-hr.; 0.375 cent for excess to 75,000,000 kw-hr.; 0.370 cent for excess to 87,500,000 kw-hr.; 0.365 cent for excess to 100,000,000 kw-hr., and 0.360 cent for excess above 100,000,000 kw-hr.

The remaining features of the contract involve provisions for arbitration in case of dispute as to service and charges, method of measuring and checking all physical quantities upon which charges are based, notification of proposed changes in demand for power on the one part and of ability to supply power in excess of contract stipulations on the other, and other details necessary to the satisfactory operation of the agreement.

The new contract has been in force for several months but has just been made public. The operation is very satisfactory and is already resulting in marked economies in construction and operation of substations.

CHICAGO CITY RAILWAY AND ELEVATED CONTRACTS

The Chicago City Railway Company has used Edison energy exclusively for nearly five years. Its original contract covered a five-year period. The new contract is, therefore, in the nature of a renewal. The railway company, however, obtains a better rate for energy and, by agreeing to the joint use of substations, co-operates in securing the economies already described. The terms of the contract are virtually the same as those of the Chicago Railways' contract.

The Commonwealth Edison Company has supplied an increasing proportion of the energy required by the five elevated railways, but the railway companies, having several power plants of varying degrees of excellence, have continued to operate the most economical of these in order to keep down the service charges and to insure an extra source of energy supply. They have now, however, agreed to take the entire supply from the lighting company for a term of twenty-five years. The principal feature in which the elevated contracts differ from the others is the provision made for the leasing by the Edison company of all power plants and substations at rentals so graduated as to cover natural depreciation of buildings and equipment. By thus controlling all of the electrical equipment the electric company will be able to operate the steam plants or not as may prove more economical, and can utilize the substations in the general distribution scheme already outlined.

WORKING CONDITIONS OF AGREEMENT

In the operation of the power plants and substations the lighting company agrees to maintain the equipment in good running order and to pay the taxes assessed against the property. The railway companies are to supply coal-handling and ash-handling service for the power plants, for which service a reasonable charge is to be made. The railway companies guarantee, however, that the cost of such service and of maintaining a satisfactory supply of water for condensing purposes shall not exceed these costs at the beginning of the contracts. The lighting company has the option of purchasing the power plants, substations and equipment on a scale of prices graduated according to years and allowing for depreciation, but at the same time either party may release the generating stations from the lease.

The electric company also gains the right to install wires and cables upon the elevated structures, with the necessary poles and cross-arms, provided that these do not interfere with the use of the structures for railway purposes.

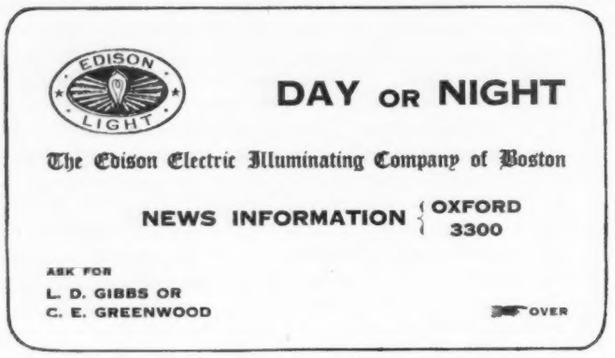
The Edison company is to furnish direct-current energy at 600 volts, and as the original contract was drawn in terms of alternating-current energy, the alternating-current equivalent of the direct-current energy is calculated on the basis of transformation efficiency at 93 per cent. The following additional charges are made for transformation: Primary charges, 30 cents per kw-hr. up to and including 10,000 kw; 26 cents for the excess between 10,000 kw and 20,000 kw, and 23 cents for the excess over 20,000 kw. The railway companies also pay a proportional share of the cost of operating the substation and an energy charge of 0.025 cent per kw-hr. for all energy delivered. They also agree to take a limited amount of energy in direct-current form at the generating stations; for example, the Metropolitan West Side Railway takes not to exceed 10,000 kw.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Central-Station "News Card"

To facilitate the supply of prompt and reliable information about happenings of popular interest on its system, the Boston Edison company has furnished its superintendent of advertising and the editor of its monthly publication, *Edison Life*, with cards emphasizing the readiness of these men to respond to press inquiries at all hours. On one side is given the company's telephone number and



"NEWS CARD" OF BOSTON EDISON COMPANY

on the other is a small map of the 700 sq. miles of territory served by the distribution system. These cards are given to local newspaper correspondents and other persons likely to be interested. In case of any event of electrical concern in any of the forty municipalities covered by the company in and about Greater Boston, reference to the card shows at a glance the exact relation of the place to the rest of the territory, checking the extent of the system for the newspaper man's convenience. The cards also carry the company's recently adopted motto, "Public service for public comfort."

Electric Truck an Adjunct to Appliance Campaign

The Denver Gas & Electric Light Company is continuing to popularize electric vehicles in its city by co-operating with dealers and helping manufacturers to introduce their products. Three or four electric commercial trucks are now available for demonstrating purposes, and the electric vehicle department of the company has induced the manufacturer of a moderate-priced electric truck to establish an agency in the city Practising in earnest its own doctrines, the electric-service company is also gradually providing its salesmen with electric cars.

Twenty-four electric trucks are being used by the company, one of which has recently been enlisted in a special delivery service. In the morning the truck is used to distribute appliances for customers' trial. During the afternoon the same wagon and its driver are turned over for the use of one of the salesmen who visits residences of customers where appliances have been left on trial. Sales are made in 75 per cent to 90 per cent of the cases of devices left on approval, it is asserted, and the remainder are brought back to the company's office on the truck. Besides saving considerably on the customary livery bill for collecting unsold appliances, the company advertises its services by displaying placards on the vehicles and also demonstrates the utility of the electric truck.

Two-Cent Rate for Electric Cooking at Jacksonville, Fla.

The trustees of the Jacksonville (Fla.) municipal plant have announced a rate of 2 cents per kw-hr. for all electricity used for cooking and heating purposes. The step was taken to develop day load for the generating station, and the use of electric stoves, ranges, cooking devices and luminous radiators will be encouraged. In premises already equipped for electric lighting no extra charge will be made for running the special heating circuit. At the 2-cent rate the local management estimates that the average household cooking bill will amount to less than $2 per month.

Trial Irrigation Pumping in Nebraska

The McCook (Neb.) Electric Company has installed an electrically operated pumping equipment on the County Poor Farm at Red Willow, Neb., to demonstrate the practicability of electric irrigation locally. The idea has prevailed that the underflow in this vicinity is insufficient for irrigation, but through the successful operation of this trial equipment it is hoped to change this opinion. The electric-service company is also negotiating with the municipality of Red Willow and with the Burlington railroad to furnish energy for pumping the water used by them.

Energy Costs in Electrically Operated Brickyards

In motor-driven brickyards the cost of production varies with the character of the clay used as the basis of the product, more power being required to grind some clay than others. In the accompanying table are given data on energy consumption and unit costs of production taken from tests made in the Connellsville region in Pennsylvania and in the Ohio Valley district near East Liverpool.

ENERGY CONSUMPTION AND UNIT COSTS

	Kw-hr. per 1000 Bricks	Cost in Cents per 1000 Bricks
Connellsville region	18	27
Upper Ohio Valley district	28	42

In these regions, where basic clay of the proper sort is found, the brick-making industry furnishes an attractive load for the electric-service companies. Owing to the hours of work in the brick plants the majority of the mill machinery is off the mains by 4:30 p. m. before the central-station lighting peak is on. This business, however, has not come to the central-station unsolicited, for the motor-service salesman has active competition to meet. As the price of natural gas for power purposes in these regions

ranges from 12 cents to 30 cents per 1000 cu. ft., prospective electric customers must be shown complete and convincing cost data before they will contract for motor drive.

Electric Trucks in "Hurry-Up" Service

Among the fields in which electric vehicles are making decided inroads upon gasoline cars are such "hurry-up" services as those of hospital ambulances, police patrol wagons and fire engines.

Nine New York City hospitals now use electric ambulances and report satisfaction with these noiseless, reliable cars. Police patrol wagons and fire engines operated by electric energy are also giving highly successful service in a number of cities.

An interesting record was recently kept of an electric fire engine in service in Brooklyn. This machine went into operation in April, 1912, and during the first year it answered 319 alarms. Its operating cost for the twelve months was $188.74, compared with $549.28, which had been the cost of maintaining horses for this service during a corresponding period.

A Co-operative Cold-Weather Window Display

Mr. J. Hartshorn, lighting contract agent for the Youngstown (Ohio) Consolidated Gas & Electric Company, has conceived the idea of putting something more in a

WINDOW DISPLAY AT YOUNGSTOWN, OHIO

window display than electrical appliances. Securing the co-operation of a local furniture dealer, the electric-service company borrowed a complete bedroom set and fitted up a model bedchamber, including all electrical appliances suitable for such a room. During the chilly days the luminous radiator and the electric bed-warming pad occupied prominent positions. The presence of furniture in the window of the electric shop caught the eyes even of those who pass the window many times every day. A neatly lettered placard in the foreground of the window gave the name of the merchant who had loaned the furniture for the display.

Refrigeration Development at Springfield, Mass.

The United Electric Light Company of Springfield, Mass., has installed 121.5 hp in motor-driven refrigerating apparatus since May 1 and now has on its lines a total connected refrigerating load of 459 hp. Twenty-eight customers are using this service, the individual plants ranging in size from 3 hp to 70 hp. Seven installations are rated at 20 hp or over each. The average rate is from 2 to 3 cents per kw-hr. on the regular power schedule. The company has not found it necessary to offer any off-peak rates for this business because the merchants served so far prefer to use their equipments at any time. The majority of the installations are equipped with automatic starting and stopping apparatus. Mr. Walter L. Mulligan, general manager of the company, reports the testimony of customers indicating a saving of 40 to 50 per cent of their former ice bills.

Electric Motor Drive in a Stationery Factory

In the accompanying illustrations are shown some of the striking features of electric motor drive as applied to the machinery of a large stationery manufacturing plant, based upon a recent critical examination of the establishment from the efficiency standpoint.

Fig. 1 shows the method of driving a ruling machine by

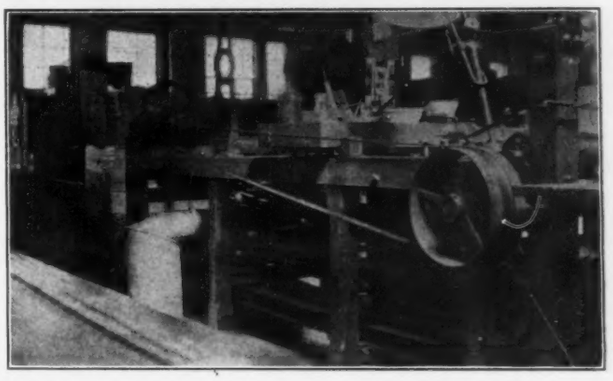


FIG. 1—RULING MACHINE DRIVEN BY VARIABLE-SPEED MOTOR

a variable-speed direct-current motor mounted on the top of the frame. The main shaft of the machine is connected with the motor pulley by a long belt, an idler being used to take up the slack and provide automatic adjustment of the belt tension. The drive is somewhat below the best standards of practice on account of the length of the belt, the

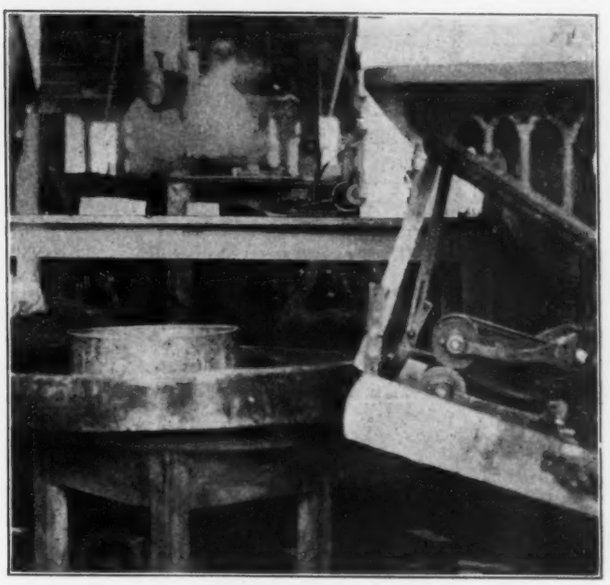


FIG. 2—MOTOR-DRIVEN CARD CONVEYOR

location of the motor far above the center of gravity of the machine and the absence of cross-bracing in the machine framing. Upon examination it was found that the vibration was too great for the best service. The unprotected belt also parallels a main aisle and is a source of danger at the machine pulley. It was considered advisable to install braces of iron rods, to place the motor near the main

shaft on a suitable bracket and to provide for silent-chain drive with protection against injury to persons or clothing in the form of a chain guard.

In Fig. 2 a convenient receptacle for ruled cards is shown. As the cards are fed from the ruling machine by a motor-driven belt conveyor, they are discharged into a pivoted circular tray about 3 ft. in diameter, the tray being swung around to the packing operator's chair as the cards are needed. The arrangement saves piling the cards roughly in a box or basket, preserves the edges of the stock, minimizes the handling and enables cards to be piled by the operator in convenient numbers without the distraction of being obliged to seize the cards as fast as they fall from the belt conveyor.

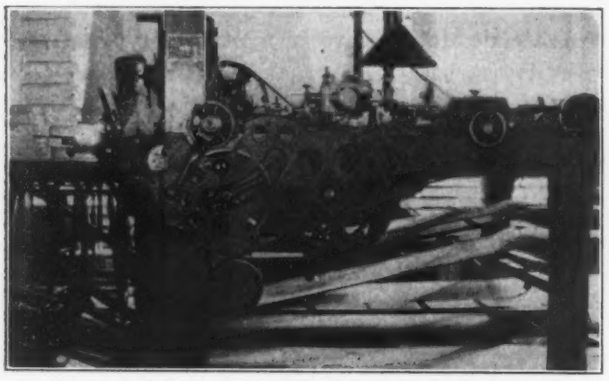
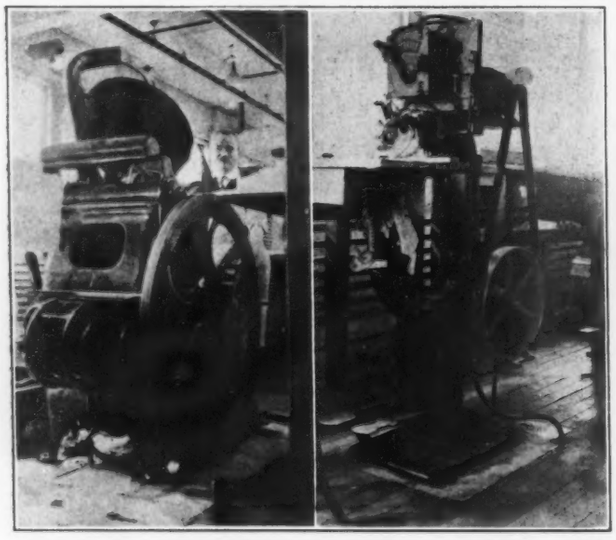


FIG. 3—PRINTING AND STRIKING MACHINE

The protection of the operator against possible injury through gearing operation is shown in Fig. 3, illustrating a printing and striking machine driven by a small motor. Examination of the gears is easily accomplished by unlatching the gear-guard casing, which is hinged at the end, and which also contains a slot by which the setting of the gears can be altered when the machine is required for striking service in connection with the inscribing of emphasis lines on the cards. Although this is a mechanical detail not directly related to the motor drive, it is a useful feature of the installation and is a safeguard of no small importance under the conditions of forced production which prevail in the plant.



FIGS. 4 AND 5—FRICTION DRIVE OF PRESS AND MOTOR-DRIVEN NUMBERING MACHINE

The convenience of motor drive is well shown in Fig. 4, which illustrates a Golding press in the plant driven by friction from a belt carried along an arc of the flywheel. The location of the motor above the floor by bolting it to the press frame renders the installation compact and facilitates cleaning under and around the machine. Complete adjustment of the belt drive is accomplished at the idler shown in the lower portion of the view. The wiring is loose and open to criticism, and the obvious recommendation was the use of conduit or flexible metal tubing from the floor outlet to the motor bushings.

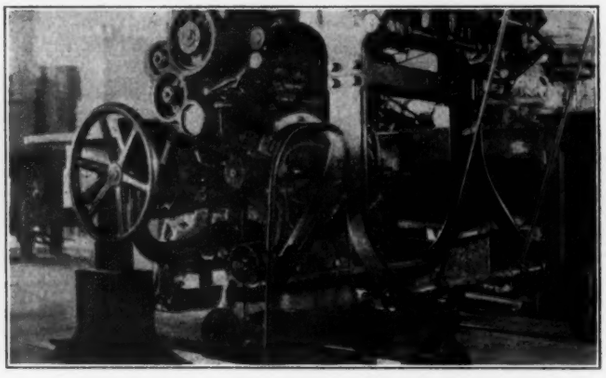


FIG. 6—COMPACT MOTOR DRIVE OF AUTOMATIC PRESS

Fig. 5 shows the compactness of the motor drive on a numbering machine in the factory. In this instance the question of vibration is unimportant, and as the machine has a metal frame with a large bedplate, there was no disadvantage in installing the motor and its controlling panel, with rheostat, on the upper portion of the machine. Useful aisle space is not sacrificed in this arrangement, as the belt drive between the motor pulley and the pulley on the main shaft of the equipment is carried inside the working table through a slot cut in the operating plane. The wiring is also carried in conduit from the floor outlet to the fuses on the machine panel. The motor may be started and stopped and the machine controlled by the operator without moving from her position on a stool in front of the machine, and the arrangement is one of the utmost convenience.

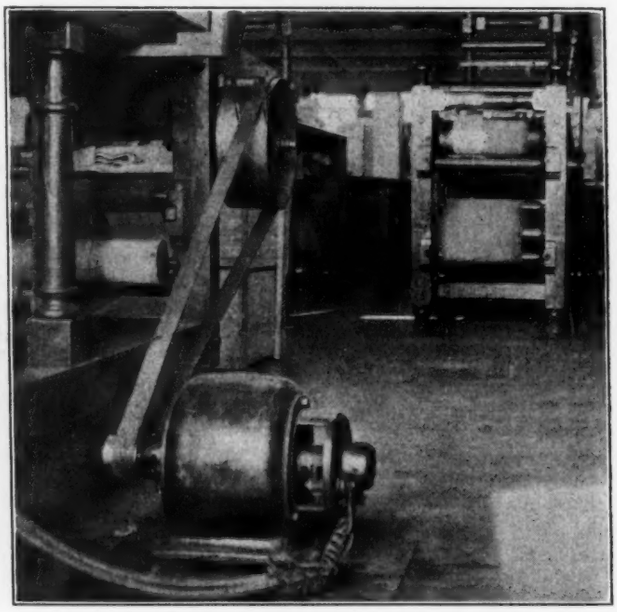


FIG. 7—IMPROPER LOCATION OF MOTOR DRIVING RULING MACHINE

The remarkable compactness of a well-designed motor

drive for individual service is shown in Fig. 6, where a 2-hp motor inside the frame of a 5-in. by 18-in. Harris automatic press operates the equipment without the sacrifice of a single square inch of floor space that could be used for any productive purpose. In this case an extremely short belt is used and the speed reduction between the motor and the main shaft is small. The use of conduit

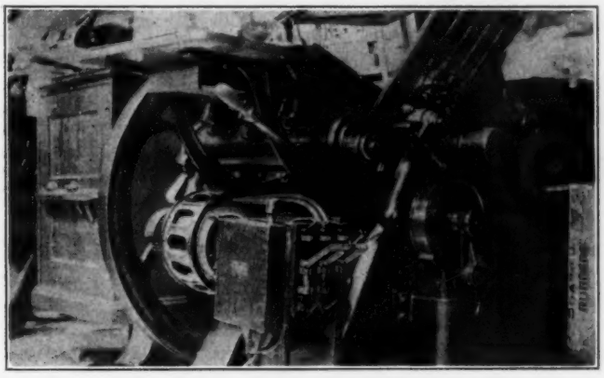


FIG. 8—PRESS DRIVEN BY 0.5-HP MOTOR

permits the 550-volt, three-phase service to be carried safely through the machine frame to the motor switch, and the motor design provides for throwing the current directly upon the rotor and fields without resistance or a compensator, thus making the drive completely self-contained. The installation of the starting switch so that the blades fall downward and open, in case of gravity action, is another useful point which avoids the danger of sudden starting, and the location of the switch inside the frame safeguards the circuit from closure by chance contact of the switch with the clothing or the hand of a passing employee.

In Fig. 7 a faulty installation is shown of a motor driving a so-called "faint-line" machine. The motor is located in the aisle in a way that consumes valuable space and interferes with free movement on the part of the employees, and the wiring is crude and unprotected. In this instance it appeared undesirable to place the motor on a bracket attached to the wooden frame of the ruling machine, and the indicated procedure for recommendation was therefore the adoption of a short, silent-chain drive, with the motor immediately under the main pulley, coupled with the use of

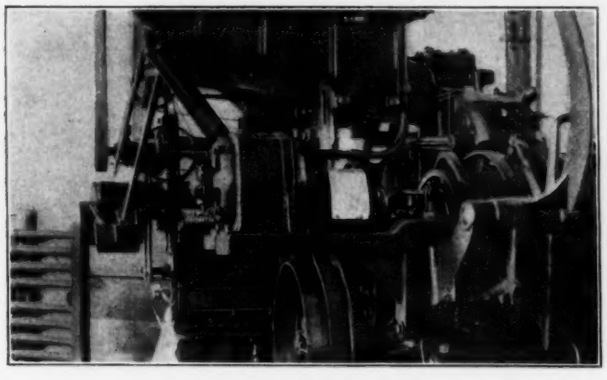


FIG. 9—LINOTYPE DRIVE THROUGH IDLER GEAR

conduit in installing the final run of wires to the motor terminals.

Another compact drive is shown in Fig. 8, which illustrates a 10-in. by 15-in. Prouty press in the plant driven by a ½-hp motor. The provision of a hand guard over the motor pinion, means of ventilating the starting box by perforations in the cover, and the use of a mechanical clutch, facilitating quick starts and stops, are the notable features. The consumption of power is also reduced by the use of a large flywheel, the motor supplying merely the energy required to maintain even rotation under moderate load conditions.

Figs. 9 and 10 illustrate recent progress in the application of motors to linotype machines in the printing section of the factory. In Fig. 9 the motor had to be mounted on a bracket high enough to clear the main pulley, and this necessitated the introduction of an idler gear between the motor gear and the gear on the main shaft. With this exception the drive accords with good practice, but in Fig. 10 a decided improvement is shown. Both motors are of 0.25-hp rating, but in the second case the motor was designed specially for linotype operation and occupies only about one-half the width on the machine required by the motor shown in Fig. 9. In the newer drive the motor was built with its pinion mounted on the shaft between the rotor and the outboard bearing, the gearing being protected by a shell attached to the motor frame and the bearing being carried by the shell. A home-made gear guard is effectively employed in Fig. 9, but in Fig. 10 the use of the shell as the guard for the gearing and for the support of the outboard bearing represents a decided advance in practice. The newer drive is more efficient, as one gear is omitted, and its

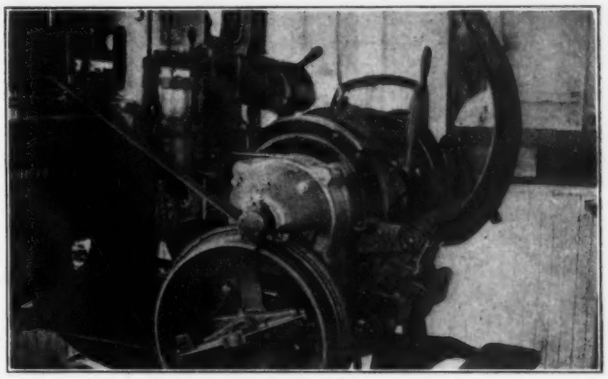


FIG. 10—DIRECT-GEARED DRIVE OF LINOTYPE WITH GUARD

increased compactness shows to what refinements it is still possible to carry motor designing.

Motor-Driven Feed Cutter Saves Liveryman $170 a Month

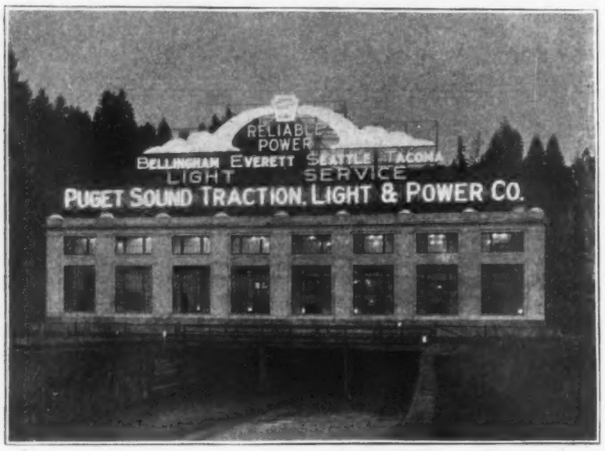
A progressive liveryman in Warren, Ohio, owning thirty driving horses is said to be saving $170 on each monthly feed bill since he installed an outfit for "predigesting" the food given to his stock. The apparatus consists of a 9-in. hay cutter driven by a 3-hp motor, a 12-hp boiler for steaming the food and a mixing vat. The total cost of the apparatus was $200 and the average monthly cost of operation is $10.

On the theory that chopped food is easier to digest and that practically all sustenance available is thus taken from the portions eaten, the amount of hay fed to these animals has been reduced 88 per cent, it is asserted, while the rations of oats and corn have been decreased 40 per cent, according to the report. Comparison of previous feed bills with those of the present dietary scheme, allowing for the cost of operating the chopping and steaming apparatus, shows an average monthly saving of $170, if the figures available are correct. The horses are doing the same daily work required of them under the former feeding conditions and no falling off in weight has been noticed. The plan has been in operation about two months—long enough to warrant the liveryman in counting the gains afforded him by its use.

Illumination and Wiring

A Huge Power-House Electric Sign

The White River hydroelectric station of the Puget Sound Traction, Light & Power Company is situated at Dieringer, Wash., 28 miles from Seattle and 13 miles from Tacoma, in plain view of passing transcontinental trains of



ELECTRIC SIGN ON WHITE RIVER WATER-POWER PLANT

the Northern Pacific, Great Northern, Chicago, Milwaukee & St. Paul, Union Pacific, Southern Pacific and Burlington routes, as well as of the Seattle-Tacoma interurban trains.

In the belief that considerable advertising value would be derived from an electric sign on this station, suggestions for such a display were requested from employees of the company, and of the many designs submitted the one by Mr. W. N. Gordanier, superintendent of the company's Electron power plant, was selected. As first proposed, the names of the cities shown were placed in geographical order from south to north, but later Mr. A. W. Leonard, general manager of the company, suggested rearranging them in the reverse order from north to south, so that the initials of the names would spell the word "Best" when all the other letters in the names were turned out, thus leaving the sign to read "Reliable Power"—"Best Light Service." The letters in these words are in red, and the remaining letters in each name come on by cities until the names are spelled out in full. The waterfall, as well as the boiling effect of the water at the bottom of the falls, is both realistic and beautiful.

The sign is 200 ft. long and 54 ft. high. It contains 4000 30-watt carbon lamps arranged in ninety-six letters, the largest of which is 8 ft. high. The sign has a total connected load of 120 kw, and its steel work alone weighs 18 tons.

Wiring Ordinance to Prevent Theft of Electricity

An ordinance recently passed by the City Council of Fort Wayne, Ind., prescribes methods for all future wiring construction and specifies positions for meter settings with a view to preventing the theft of electricity which has been prevalent in the past. The ordinance requires that all wiring shall conform to the standards of the National Electrical Code, and in addition demands that all service wires shall be inclosed in approved conduit from the point of entrance to the meter centers. If the meter is installed on the exterior of the building, the service wires shall, according to the ordinance, be inclosed in conduit placed on the walls of the building.

A clause relating to the setting of electric meters recommends that preferably all meters shall be placed on the outside of the building and that in no case shall they be above the first floor. It is further provided that all meter centers shall be placed ahead of the main-line switch and branch blocks where service wires are protected by a fused cut-out.

The hope is expressed by the local central-station company that the extensive use of inclosed wiring and also of protective meter panels will reduce losses from theft of electricity.

Ornamental Street Lighting in Hiawatha, Kan.

By H. S. Woods

Hiawatha, Kan., is a town of 3500 people situated in the farming section in the northeastern part of the State. It has two electric-light plants, one a private corporation furnishing energy for industrial and private uses, and the other a municipal plant supplying energy only for street-lighting purposes and for operating the city water-works.

The feature of the street lighting is the large amount of it that is done by series tungsten lamps, mounted on ornamental iron posts, both on the main streets and in the residence portion of the town.

Until two years ago the streets were lighted by series, direct-current, inclosed carbon arc lamps, operated from an arc machine. At that time the first contract for street paving was let, and, needing additional street-lighting equipment, Mr. V. L. Dawson, superintendent, replaced the inclosed arc system with a fifty-lamp mercury rectifier set, including lamps, and installed the first part of the series tungsten lighting system that has spread all over the city as fast as the paving has been extended.

As soon as the present contracts are completed the city will have 5½ miles of pavement and 315 ornamental posts. The posts are manufactured in Hiawatha, being made up of a 30-in. ornamental cast base, a 48-in. section of 3-in. iron pipe and a 60-in. section of 2½-in. iron pipe joined by reducers, on top of which is mounted the holder for the socket and inclosing globe. The base of this globe is 12 ft. above the sidewalk. A 14-in. Alba globe is used with the 100-cp, 6.6-amp lamps used on the business streets and a 12-in. Alba globe with the 60-cp lamps in the residence districts.

On the business streets forty-eight posts with 100-cp, 6.6-amp series lamps are used, eight posts being placed per block, four on each side of the street. In the residence districts there are 267 posts, with 60-cp, 6.6-amp series

LIGHTING ON BUSINESS STREET

tungsten lamps, spaced 200 ft. apart and staggered on opposite sides of the street, thus giving five posts per block, three on one side of the street and two on the other side.

Energy for the lamps is furnished by two constant-current transformers, through No. 8 single conductor, steel-taped cable, known as C. L. A. I. finished, some having rubber insulation and some varnished cambric. A total of

42,000 ft. has been used. In the business section the cable is laid under the pavement; in the residence section, where the paving is 30 ft. wide, generally, the streets being boulevarded, the cable is laid in the dirt, just inside the curbstones. The cable is run up in the posts to the sockets.

ORNAMENTAL LIGHTING IN RESIDENTIAL DISTRICT

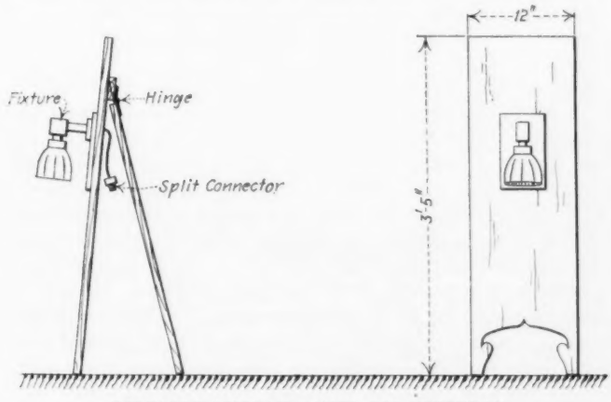
Half of this system has been in service more than a year, and the citizens have been so well pleased with its ornamental appearance and illuminating value that they have insisted upon its being extended wherever paving has been done, with the result that Hiawatha is one of the best lighted cities, of its size, in the State.

DATA ON HIAWATHA POSTS

Cost of bare posts, each	$12.00
Post set up (including lamp, socket, inclosing globe, concrete base for foundation, and labor), each	15.00
Average cost of cable, per 1000 ft	100.00
Cost of laying cable in business section, per 1000 ft	20.00
Cost of laying cable in residence section, per 1000 ft	10.00
Approximate average life of lamps	1400 hr.

Portable Display Panels for Wall Fixtures

Portable panels for exhibiting electric wall fixtures are being used to advantage in the salesrooms of the Commonwealth Power Company, Jackson, Mich. Fixtures displayed on these panels are shown to better advantage than when grouped on the walls of the display room. In addition, the prospective purchaser may be seated while the different types of fixtures are being exhibited.



PORTABLE DISPLAY PANEL FOR FIXTURES

The panels are inexpensive, being made of yellow pine which is stained and grained to resemble oak. The accompanying illustration shows the construction of a panel and the method of mounting and connecting the lamp fixture so that it may be lighted while being displayed. The panel measures 12 in. wide and 41 in. high and is supported in an upright position by a leg hinged to the back. By using a flexible cable and a split-plug connector the lighted fixture may be exhibited in several positions. Mr. C. L. Falkinburg, who is in charge of the appliance sales department, devised this method of displaying fixtures and reports that by using the panels the company has sold many fixtures which had been in stock for a long time. The cost of material, labor and finish for eighteen of these panels amounted to $10 and the results obtained from their use are more than gratifying.

Maintaining Alignment After Moving Corner Pole

When to facilitate reconstruction the telephone company's corner pole shown in the illustration was erected at a position about 4 ft. to the right of the site of the former pole on this corner, the electric-lighting lead which had occupied an auxiliary cross-arm at the top of the old pole was thrown out of line. An energetic lineman, however, with a desire for straight-line symmetry moved the small arm with its support to the end of the main arms of the new pole. The upright piece used consists of a standard 10-pin fir cross-arm. It is bolted to the telephone cross-arms by means of the space bolts used for holding the double arms in position. The construction was inexpensive and serves admirably.

SPECIAL CROSS-ARM FOR MAINTAINING ALIGNMENT

Ornamental Luminous-Arc System for Worcester Mass.

Plans are nearly completed for the installation of 300 ornamental luminous-arc lamps of 6.6-amp rating on the principal business streets of Worcester, Mass., the local merchants' associations having reached an understanding as to the type of illumination desired. Tentative agreements with the Worcester Electric Light Company have been discussed as to prices for service, and it has been figured that about 2.6 lb. of coal will be required at the company's plant for every kilowatt-hour delivered at the lamp: Fuel costs about 40 cents per ton more in Worcester than in adjacent seaport cities, and this factor is being considered by the company and the lighting committee of the City Council in arranging rates. A two-circuit installation will probably be made to enable half the lamps to be cut out at midnight. It is expected that the price to be paid by the city per ornamental lamp per year will not exceed the present unit cost of 4.4-amp all-night magnetite lamp service.

The Eye as a Judge of Uniform Illumination

By J. R. Cravath

Although it is commonly known to illuminating experts that the eye cannot readily judge small differences in any illumination when the surfaces illuminated at different intensities are not close enough together for the contrast to be evident, yet it is doubtful whether even experts fully appreciate how great differences in illumination will be passed upon by the casual observer as being practically uniform. For this reason it is believed that some of the test results outlined below will prove of peculiar interest as showing how far from uniform the illumination may be and nevertheless be considered uniform by the ordinary observer.

Dearborn Street, Chicago, to the ordinary observer, at night has nearly uniform illumination on its street surfaces. The lighting of this street is by flame-arc lamps of the type now standard for Chicago street lighting, having vertical electrodes. There is one arc lamp on each electric-railway pole hung on a bracket extension on the top of each pole, so that the arc is about 25 ft. above the street level. The poles are placed from 110 ft. to 125 ft. apart along each curb. The street is 80 ft. wide. The unusual height of these lamps and their broad distribution of light give the general effect of a uniformly illuminated street surface. Another casual test for uniformity made by the writer was that of looking at the street surface while standing in a street car passing along the street. The lamps themselves would then be invisible. By looking intently at the street surface as the car passed along the variation in brightness or the illumination of the street surface seemed very small.

After making these casual observations with the eye the facts were investigated by means of photometric measurement. The horizontal illumination determined with a Sharp-Millar photometer at five points aong the curb line showed a variation of fully ten to one in foot-candles between the points under the lamps and points midway between the lamps. This result brings out forcibly the inability of the eye to judge differences in illumination unless these differences are in contrast with each other side by side as in the case of sharp shadows. In the case just described the merging from 1 ft.-candle to about 0.1 ft.-candle midway between lamps is so gradual that no one but an expert woud detect it unless the attempt were made to read a newspaper or do similar close work with the eyes while passing along the street. The latter test would indicate considerable difference.

Another illustration of the inability of the eye to judge differences of illumination where there is a gradual merging from one degree of illumination to another is in the case of shadows with an indirect system of lighting. The writer once tested the relative density of the shadow cast by a person's head at a given distance from a desk top in a room lighted with a number of direct units and later in a room lighted with a similar number and location of indirect units. The point of maximum shadow was selected in each case. With the indirect system it was only after very close observation that the point of greatest shadow in the room could be found, as apparently there was very little shadow. With the direct system no difficulty was encountered in locating the point of greatest shadow. Nevertheless, photometric tests showed that with the indirect system the illumination at the middle of the shadow was reduced 45 per cent because of the shadow, while with the direct system the illumination was reduced 51 per cent because of the shadow. The pronounced character of the direct shadow as compared with the indirect was due therefore largely to the fact that the shadow with the direct system had a sharp edge while with the indirect system there was simply a gradual merging from the shadow to the edge, and the shadow was therefore indefinable.

The practical lesson of the above observations is that satisfactory illumination is not necessarily very uniform and the variations permissible are much greater then are usually thought. In planning illumination the avoidance of sharp or sudden contrasts will compensate for much lack of uniformity.

A 32,000-Lamp Electric Sign for San Diego, Cal.

A permit has been issued by the San Diego (Cal.) building department for the erection of what it is said will be the largest electric sign in southern California. The display, which will contain 32,000 lamps, will be 48 ft. high and will be placed on the roof of the Josse Building. It will cost $10,000. Across the top in large letters will appear the slogan: "San Diego, First Port of Call," while the lower half of the sign will be devoted to flashing electric displays of business firms. Energy to light the sign will be furnished by the San Diego Consolidated Gas & Electric Company.

Recent Telephone Patents

With central-energy signaling systems, where the battery is continuously connected across the line, any point of low insulation resistance manifests itself not only through waste of energy but also at times through electrolytic action. It is to obviate these conditions that Mr. G. A. Betulander, of Sweden, has developed a system in which the battery is connected to the lines only during actual use. The result is accomplished by providing the stations with hand generators, by means of which the energization of the battery control is effected.

Mr. E. R. Corwin, of Chicago, has patented a common battery system in which the connecting cord circuits are devoid of signal lamps, the calling and supervisory signals being produced at the line lamp. This lamp indicates the arrival of a call, the desire for disconnection, and also, through the application of a special current, shows the exact condition of the circuits pending response of the called station. The cord circuits are further arranged so that the operator's set is connected and disconnected automatically, as the occasion demands. Ringing is automatically accomplished and an audible, ringing signal is sent back to the calling party. Mr. Corwin has obtained a second patent and, in conjunction with Mr. C. A. Bals, of Chicago, a third patent, describing different arrangements for controlling the connection and disconnection of the operator and ringing current for similar automatic ringing-and-listening manual systems. All of these patents have been assigned to the Corwin Telephone Manufacturing Company.

Three other patents which have been granted to Mr. E. R. Corwin and assigned to the Corwin Telephone Manufacturing Company describe an intercommunicating private branch system, adapted for use with automatic exchange systems. With such a system it is necessary that each terminal of the intercommunicating system be capable of selecting at will an exchange trunk line. It is further necessary that a special station, designated a receiving station, shall be able to answer any trunk line and hold this line while connected with one of the other stations. This arrangement involves the necessity for any station to hold at will any trunk line against interference by other stations, even though having disconnected itself momentarily from the trunk line.

The circuits and system described by Mr. Corwin provide for these necessary features and for the visual signals at the receiving station to indicate the condition of the various trunk lines. The system as described is equipped with a key bank at each intercommunicating station by the manipulation of which the user may carry out the various switching functions.

Letters to the Editors

The N. E. L. A. and Motor Service

To the Editors of the Electrical World:

SIRS:—Years ago, when the National Electric Light Association was young, illumination was properly the chief topic for consideration and discussion. At the present time, however, in many of the large systems electric light is a by-product and motor service is the chief source of income, as Mr. Samuel Insull has recently pointed out. So interwoven are the problems of generation, transmission and utilization of electric energy that they must be considered concurrently. The utilization of electricity for lighting is well reflected in the activities of the National Electric Light Association, but motor service and motor application are relatively ignored, although the possibilities along the line of the correct application of electric motors in the various industries seem almost limitless with reference to the increased sale of energy from central stations.

In spite of its name, which might appear to limit its activities, the National Electric Light Association could well pay a greatly increased amount of attention to the subject of motor service by encouraging the presentation and discussion of papers on the subject and arranging for large exhibits of motor-driven machinery. It certainly does not seem unreasonable to hope that such an exhibit would come to be the Mecca to which would go annually many of the persons interested in the use of the electric motor in manufacturing operations. With the rapid increase in the use of purchased energy, the National Electric Light Association seems the proper organization to take the initiative in establishing recognized headquarters for the consideration and exhibition of electric motors operating all kinds of machinery.

Cleveland, Ohio. H. F. STRATTON.

[In response to our request for his comments on the above subject Mr. Joseph B. McCall, president of the National Electric Light Association, has sent us the letter printed below.—EDS.]

To the Editors of the Electrical World:

SIRS:—To anyone familiar with the central-station industry in this country, or who has made a close study of the tendencies of the time, as evidenced by modern manufacturing methods, efficient factory practice, etc., it comes somewhat as a shock to be asked why the utilization of electricity for motor service is being relatively ignored by the central-station interests.

It is true, as pointed out in my address before the Pennsylvania Electric Association, that in the early days our business was primarily that of furnishing electric illumination. Electric power, even after it was found to be practicable and desirable, was looked upon for the moment as a by-product for a few years. We had to grow a little before developing our business in a well-rounded manner. We built up the lighting load as rapidly as possible, and then began the effort to secure the very valuable power load, especially what might be termed the large wholesale user.

Increasingly more attention is being given by all central stations in the country to the matter of building up a motor load. Thousands of electrical horse-power are being added daily to the circuits of the various stations throughout the country. All the larger companies specialize in their efforts to increase the motor load, in which they have been ably aided and abetted by the manufacturers, so that to-day the factory which does not employ the electric motor for group or individual drive is considered out of date, even though that factory is not obtaining energy from the central station.

Many of us, also, are reaching out into fields heretofore considered outside of our province, and we are acquiring a railway load which in the earlier days was not dreamed of. As a proof that neither the central-station industry nor the National Electric Light Association, which represents the best thought of all those interested in the central-station industry, is neglecting the importance of the motor load, it is only necessary to quote statistics which show that while the central-station income from commercial lighting has increased 226 per cent during the past ten years, the income from the industrial power load has increased by 764 per cent.

A state or sectional convention never takes place which does not include papers on electric motor applications, and assuredly this subject will always maintain its proper place in our convention programs. J. B. MCCALL,

Philadelphia, Pa. *President N. E. L. A.*

Diversity-Factor and Load-Factor

To the Editors of the Electrical World:

SIRS:—In your issue of Nov. 8 in reply to a request for a definition of diversity-factor you give the ratio as the reciprocal of that given by the American Institute of Electrical Engineers. Under Section G, "Definition and Explanation of Terms of the Standardization Rules," is the following: "(11) Diversity-Factor. 51a. Diversity-factor is the ratio of the sum of the maximum power demands of the subdivisions of any system or part of a system to the maximum demand of the whole system or of the part of the system under consideration, measured at the point of supply."

It is probably a matter of opinion, but a factor which cannot exceed unity seems much more fitting than one that is always greater than unity.

In connection with "factors" and their definitions, is it not about time something was done toward getting load-factor more clearly established? The Institute in its standardization rules gives no definite time and only states: "The load-factor of a machine, plant or system is the ratio of the average power to the maximum power during a certain period of time." It would seem that only one time interval could be considered, namely, 8760 hours per year. Fixed charges, which are very closely related to load-factor, are considered as extending over every hour in the day, month or year and are independent of normal operating hours or actual running hours. Methods of measuring the maximum demand vary widely. Graphic instruments will approximate the momentary peak, but it is customary with some companies to integrate these records over periods varying from a few minutes to a half hour. Other instruments will measure a lagged demand, but the lagging is very variable. Some instruments have a straight-line lagging curve and hence a true average for the specified interval, while others have curves of a higher degree and varying time intervals. It seems a pretty poor "factor" that necessitates the statement of a number of conditions before its value can be given. Even after all the unknown quantities become known it is often necessary to convert them to another "system" in order that the result may have a comparative value. Operating reports at times show a generator load-factor of 100 per cent when the machine is in use for only one hour out of twenty-four, while motor-service data published by one of the large manufacturers of motors is based on the average and connected load, although there is little relation, in many installations, between the demand and the sum of the motor ratings.

New London, Conn. CECIL W. BROWN.

[Diversity-factor was defined on the percentage basis, used by us, in the report of the N. E. L. A. committee on terminology and printed on page 370, Vol. III, of the *Transactions* for 1912.—EDS.]

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Cost Data on Electric Welding

Some interesting figures on the cost of electric welding and the time required for various jobs are shown in the accompanying table of data based on the experience of several leading railroads as reported to the shop-practice committee of the Association of Railway Electrical Engineers.

TIME AND COST OF REPAIRS BY ELECTRIC WELDING

Steel casting, crack 6 ft. long by 1 in. deep, eight minutes	$0.04
Steel casting, riser 4 in. by 4-in. cut-off, four minutes	0.05
Forged-steel locomotive frame, two breaks, twenty hours	18.28
Crack 12 in. long in boiler back-sheet, nine hours	5.47
Cast-steel tender frame, three breaks, twenty-seven hours	19.00
Broken railway-type motor case, cast steel, three hours	1.95
Enlarged holes in brake levers, steel bars, four minutes	0.05
Air-brake piston rods, broken, thirty minutes	0.35
Cracked axle boxes, welded in place, fifteen minutes	0.15

SAVINGS MADE BY REPAIRS INSTEAD OF REPLACEMENTS

Armature shaft repaired in place, worn journals	$13.16
Railway-motor axle cap, large, cracked	3.29
Railway-motor armature bearing cap, broken	5.80
Railway motor gear case, top half broken	6.82
Truck side frame, Brill 27-G, broken	43.68
Truck side frame, Peckham 14-B, broken	46.08
Motor frame, GE-90, railway type, cracked	13.92

SAVINGS MADE BY ELECTRIC WELDING OVER OTHER PROCESS

Engine main frames, both broken	$44.40
Driving wheel built up on tread, 3/16 in.	7.28
General repairs on fire-box side sheets	276.11
Filling in worn knuckle-joint bushing hole	6.75
Locomotive cylinder casting, seven cracks	344.50
Broken mud ring on locomotive boiler	85.99

In its own report presented before the recent Chicago convention, the committee pointed out its conclusion that welding by electricity is cheaper than by any other process, since electric welding requires only one-half the time and involves one-third of the expense of other methods. Proof that electric welding has passed beyond the experimental stage is furnished by the fact that about 1000 locomotives are to-day running on American railroads each with some electrically welded part.

Coals of the United States

Much valuable information on the subject of the coals of the United States is contained in Bulletin No. 22, just issued by the Bureau of Mines, describing analyses of 5000 samples of coal taken from 1500 mines in various American fields. Pains have been taken to present reliable information regarding the chemical composition and heating value of the fuels, the samples having been collected by experienced men and analyzed under carefully controlled conditions.

An increasing proportion of the coal consumed in power stations is being purchased under specifications based on chemical and calorimetric analyses. In any particular market the choice of coal is generally limited by its quality and by freight rates to one or two fields in which the character of the coal bed is comparatively uniform. By having on hand a representative analysis of the coal from a given district, the engineer can "check up" whether the coal he receives comes from the bed and district stated and whether it is being prepared for the market as carefully as it should be. Wide variations in the composition and heating value of coals from different districts and from different beds make analyses that are comparable (because of the care taken in sampling and analyzing the coal) almost indispensable to engineers having to install boiler or gas-producer plants in different cities.

The report just issued by the Bureau of Mines is in two parts, one describing the methods used in collecting and analyzing the samples and the results of the analyses, and the other giving the exact location from which each sample of coal was taken, together with a description of the characteristic features of the coal bed at the point of sampling, the nominal capacity of the mine and such notes on the preparation of the coal as may be useful to consumers. The data contained in these two volumes have never been equaled in scope and detail or in value for comparative purposes by similar figures published by any other coal-producing country in the world.

Copies of this bulletin may be obtained by addressing the director of the Bureau of Mines, Washington, D. C.

Installation of Oil Burners

By R. T. Strohm

When installing oil burners the piping should be provided with unions near the burners, to facilitate the work of

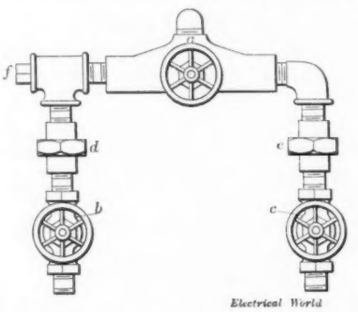


FIG. 1—PIPING FOR GEM OIL BURNER

taking them down when they must be repaired. This point is very clearly illustrated in Fig. 1, which shows the piping for a Gem burner *a*. The oil flows to the burner through the valve *b* and the connecting pipes, and the steam for atomizing is admitted through the valve *c* and the branch to which it is fitted. The unions *d* and *e* enable the burner to be detached from the system very easily and quickly. The plug *f*, when removed, allows the connection to be cleaned out. The valve *b* is closed, and a cap is placed over the end of the burner so that the steam will back up in the burner and blow back through the oil connection, cleaning it.

The pipe connections for a Best burner are shown in Fig. 2 in a diagrammatic way. The burner is located at *a* and the oil and steam lines are attached on opposite sides. There are unions *b* and *c* to facilitate the removal of the burner and stop valves *d* and *e* for oil and steam respectively. In addition, there is an oil-regulating cock *f*

between the stop valve *d* and the burner, to enable the flow of oil to be regulated with great precision.

An end view and a vertical section of the regulating cock are shown in Fig. 3. It consists of a conical plug *a* that fits a conical seat in the body *b* of the cock and that is held snugly in place by the upward pressure of the spring *c*. The spring is kept in position by the extension *d* on the

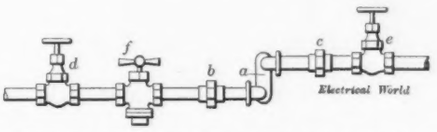


FIG. 2—PIPING TO BEST BURNER WITH OIL-REGULATING COCK

bottom of the plug and by the cap *e*. The latter can be unscrewed so as to allow the plug and the spring to be removed from the body of the cock. The oil flows through a triangular opening *f* in the plug. The opening is made triangular in form so as to insure close regulation of the oil. The opening *g* in the body of the cock on the outlet side of the plug is rectangular in shape and the outline of this opening is dotted around the opening in the plug. By turning the plug slowly, the amount by which the triangular opening overlaps the edge of the rectangular outlet can be varied very gradually, thus giving close adjustment of the oil supply to the burner. The packing *h* around the stem of the plug is compressed under the screw cap *i* and prevents leakage of oil around the stem.

The cock is opened fully or closed completely by giving the handle *j* a quarter turn. There is a lug *k* on the handle, and it comes against a stop *l* cast on the body of the cock when the plug is turned to the closed position. Also, there is a knurled screw *m* in a bracket *n* fastened to the body of the cock. When the plug is turned to open the cock, the lug *o* comes against the point of the screw and the handle can be turned no farther. The screw can be adjusted to give any desired amount of opening of the cock, and the cock can be opened and set instantly to this position. The bracket *n* is hinged, and if the cock is to be opened to its full extent, the bracket is simply swung upward and backward, taking the stop screw *m* out of the way of the lug *o*.

A form of valve for regulating the flow of oil with extreme nicety is shown partly in section in Fig. 4. The inner end of the valve stem carries a hollow cylinder *a* that fits snugly in a circular hole in the seat *b*. In the side of the cylinder is cut a triangular opening *c*, so that, when the stem is screwed out, the point of the triangular opening rises above the face *d* of the seat and allows the

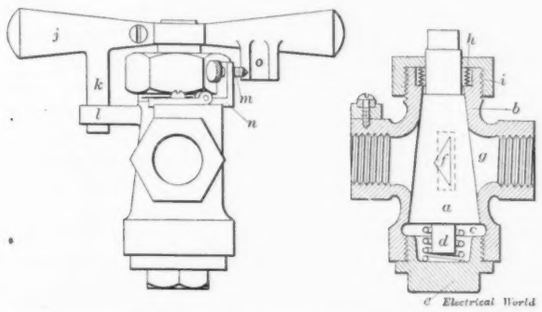


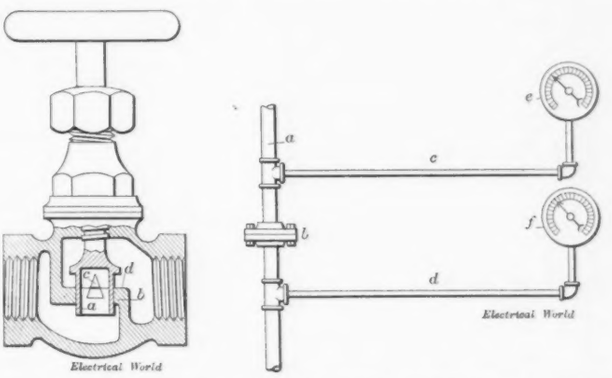
FIG. 3—COCK FOR REGULATING OIL SUPPLY TO BURNER

oil to pass through. The higher the stem is drawn, the greater is the amount of opening.

Owing to the penetrative nature of oil fuel, the piping should be carefully put together and all joints should be tight. In making up the connections the pipe threads should be perfect and should be cut in oil, so as to be smooth and free from cracks. If the threaded end is made too long the pipe will screw into the fitting too easily and leakage may result. It is better to cut the threads so that it will require a considerable force on the pipe wrench to put the pipes together, as this will be more apt to give tight joints.

The pipes leading to and from the storage tank are usually permanent and are not likely to be taken apart, so the joints may be made up with a cement of litharge and glycerine to insure tightness. If it is possible to do so, elbows should be avoided in installing the oil piping, as the foreign matter in the oil will collect at these fittings and eventually clog the pipes. It is preferable to employ bends of long radius instead of elbows. It will be found advisable to arrange the piping in such a way that the oil can be turned off and live steam sent through the oil lines to loosen the deposits of asphalt or tarry matter and blow them out of the pipes.

The proportions of the furnace and the style of oil burner to be used will govern the number of burners that must be supplied in a given installation. To illustrate, if a furnace is long and narrow, a single burner giving a long, conical flame will be sufficient; but if the furnace is short and narrow, a single fan-tailed burner will give the desired results. In case the furnace is wide, two or more burners may have to be installed. Some makes of burners are so constructed that they can be made to throw a long, narrow flame or a short, wide one. It may be said that, as



FIGS. 4 AND 5—OIL-REGULATING VALVE, AND ARRANGEMENT FOR FINDING STEAM USED BY BURNERS

a rule, one burner for each 6 ft. or 7 ft. of width of furnace will be required. The capacity of the burner must also be taken into account. One manufacturer guarantees a capacity of from 5 to 350 boiler-hp with a single size and type of burner. Another rates his burners at from 75 to 100 boiler-hp each. Still others manufacture different sizes of burners of the same type, each size corresponding to a certain capacity.

The location of the burner is a matter that cannot well be considered apart from the furnace arrangement. In the case of the return-tubular boiler, it is common to find a burner in the center of each fire-door; but if sufficient capacity can be obtained by the use of a single burner it may be inserted through an opening between the fire-doors, cut through the boiler front and the front wall of the furnace. Whatever the location of the burner or burners, the furnace space should be utilized as far as possible. This is one reason why it is found advisable in some instances to locate the burners at the rear end of the furnace in inclined-tube water-tube boilers.

The importance of supplying dry steam for atomizing cannot be overestimated. A steady white flame is produced if the steam is dry; but if water is carried along with the steam the burner sputters and combustion is retarded. The presence of water in the steam may be due to priming of the boiler or to condensation in the pipe line leading to the burner. One way of avoiding such moisture

is to superheat the steam, which can be done very easily by running the steam pipe from the boiler to the burner through the furnace or the boiler breeching. Such an arrangement, however, is not always convenient. It is advisable, then, to put a steam separator on the steam line near the burner, in which the steam will be freed of its moisture. This is accomplished by an abrupt change in the direction of flow of the steam, by centrifugal force set up during a whirling motion caused by spiral guides or vanes, or by the separating action of baffle plates. The moisture collecting in the bottom of the separator may be removed through a drip or by an automatic trap.

The economy of a burner is measured by the amount of steam it uses to atomize a pound of oil. There are several ways of determining this, but the simplest way is to condense the steam that issues from the burner in a given time, weigh it, and compare it with the amount of oil used in an equal period. A tank of cold water is set on scales and weighed accurately. Then the burner, with the same piping and connections as are used in ordinary operation, is submerged in the tank. The steam valve is then opened to the same extent as during the normal working of the burner and is left open for a definite time, say, a quarter of an hour.

The steam escaping from the burner will condense in the water in the tank, increasing the amount of water and the temperature. At the end of the given time the burner is removed and the tank and its contents are weighed again. The increase of weight represents the amount of steam used in the observed time. The accuracy of the test may be checked by taking the initial and final temperatures of the water in the tank and calculating how much steam at the usual working pressure would be required to produce the observed rise of temperature in the known weight of water. This result should agree fairly well with the increase of weight of the water in the tank. The amount of oil used in the same length of time can be calculated from the readings of the telltale on the tank, or from the readings of the meter on the oil line, if there is one installed.

This method is very simple and the apparatus is commonly available; but there is the disadvantage that during the test the burner does not operate under the same conditions as in service. When the burner is atomizing oil the issuing steam meets the resistance of the viscous oil in the mixing chamber or at the orifice, whereas in the testing tank the resistance is due to the water. These resistances differ more or less, and the greater the difference the greater the error in basing the economy of the burner on the results of the test. It is probable that the water will offer less resistance than the oil, so that the test will show the burner less economical in steam than it really is.

A more nearly accurate test may be made by using the apparatus shown in Fig. 5. The vertical pipe *a* leads to the burners and conveys the steam for atomizing. Between the two flanges *b* on this pipe is a thin plate in the center of which a hole 3/8 in. in diameter is drilled. The steam flows through this orifice in the plate on its way to the burners. On opposite sides of the flanges the pipes *c* and *d* are connected, leading to the steam-pressure gages *e* and *f*. The gages register the steam pressures on opposite sides of the orifice in the plate, and these pressures vary according to the amount of opening of the steam valve, and hence according to the rate of flow of steam. A series of tests are made with different openings of the steam-regulating valve, observing the pressures on the gages and catching and condensing the steam in a weighing tank filled with cold water. In this way a table is made up showing the amount of steam flowing through the plate in a given time for each different combination of pressures. After such a table is once compiled the steam consumption of the burners at any time may be found quickly by observing the pressures registered by the gages and then noting the corresponding steam rate in the table.

Installation of Customers' Meters

Will you describe an approved construction for installing a watt-hour meter in a restaurant kitchen? No other place is available, according to the customer, whose business and friendship we are anxious to secure.
K. M. C.

Where a meter must be installed in a kitchen of this kind, or in any other place where it will be continually exposed to fumes and dampness, some kind of a moisture-proof box is essential. Wooden partitions should be avoided. Some vertical support free from vibration should be chosen. Exposure to the weather, even indirectly; sweating of water pipes, humidity from open tanks and moisture from various sources are some of the conditions to be especially avoided. In general, meters should never be installed in closets, bathrooms, toilets, bedrooms, attics or coal bins.

Load-Factor and Diversity-Factor

Kindly furnish me with definitions of load-factor, diversity-factor and demand- actor. I have several conflicting definitions of these terms and would like to know which is correct.
H. M. G.

The confusion in terms reported by the correspondent is not surprising, for even the definitions as set down by the national electrical societies differ and in the case of diversity-factor are flatly contradictory. "Load-factor" is defined in the standardization rules of the American Institute of Electrical Engineers as the ratio of the average power to the maximum power during a certain period of time, such as a day or a year. Several different kinds of load-factor, on the other hand, are described by the National Electric Light Association committee on terminology in its report at the 1912 Seattle convention. "Connected load-factor" it defines as the ratio of the actual energy consumption to the energy which would have been consumed had the apparatus been in continuous operation at full rated load during the same period. "Capacity load-factor" for a generating station is similarly defined as the percentage ratio of energy actually generated to that which might have been generated by continuous operation at full rated load. The "maximum-demand load-factor" is stated to be the ratio of actual generation to the generation which might have been recorded had the plant operated continuously at its maximum load or output during the period. Again, the "daily load-factor" is obtained by taking the mean load for one day and dividing it by the peak load for that day. Similarly "yearly load-factor" is the ratio of the mean annual load to the peak load recorded during the year. There is also a confusing variety of usage in the number of hours per day on which the load-factor is to be based. Some engineers employ the eight-hour or ten-hour working day of the shop or factory in which the motors under consideration happen to be used. Others have preferred even the twelve-hour day. Obviously it would seem that all should agree on the twenty-four-hour day as the natural period, although on this basis the resulting load-factor percentages appear low. The scheme has, however, the advantage that a change in the length of the working day cannot make the load-factor appear greater than unity, and it also permits all systems to be compared on a common natural basis. "Diversity-factor" is defined by the N. E. L. A. rules as the ratio between the simultaneous demand of a number of individual services and the sum of the individual maximum demands of the same services. Diversity-factor is thus expressed in per cent and is a fractional quantity which can never be greater than unity. A definition exactly reversed is, however, given in the A. I. E. E. rules, where diversity-factor is defined as the ratio of the sum of the maximum demands to the maximum demand of the whole system. By this definition the diversity-factor will always be a number greater than unity. The "demand-factor" as defined by the A. I. E. E. rules represents the ratio of the maximum power demand of a system to the total connected system load.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Modified Induction Motor.—In the construction of alternating-current induction motors considerable valuable magnetic space is taken up by the windings in both the stator and the rotor. To reduce this space considerably with various resulting advantages is the object of a motor designed by Messrs. W. P. Durtnall and A. H. Binyon. The motor (Fig. 1) is especially adapted for industrial drive or

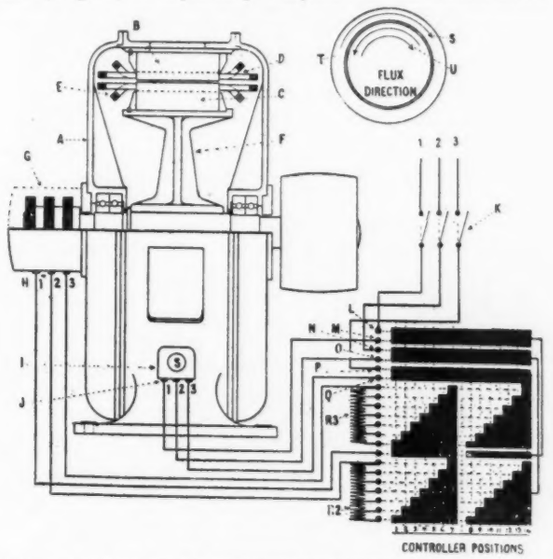


FIG. 1—DIAGRAM OF THE STANDARD THREE-PHASE MOTOR AND CONTROLLER

factory use. *A* is the cast-steel frame, *B* the stator stampings, *C* the rotor stampings, *D* the stator windings, *E* the rotor windings, *F* the cast-steel spider of light but strong construction, *G* the slip-rings for the rotor windings, *H* the insulated bushes taking the leads to the slip-rings, brushes or rubbing contacts, *I* the terminals of the stator windings, *J* the insulated bushes for the leads to same, and *K* is the main switch. Phase No. 1 is connected to controller terminal *L*, phase No. 2 to terminal *N*, and phase No. 3 to terminal *P*. Thence the current passes to terminals *M*, *O* and *Q*, and to stator terminals Nos. 1, 2, and 3. Assuming an eight-pole motor running on 50-cycle, three-phase current, the operation is as follows: Current from contact No. 1 is sent to the stator windings, which causes the resulting magnetic flux in the stator iron to revolve in the direction marked *S* in the circle diagram. At the same time the rotor is short-circuited by means of the three leads from the slip-rings to the controller, but, as rotor windings are wound for the same voltage and polarity as those of the stator, two compensating choking coils are inserted to stop an excessive amount of current flowing. Contacts Nos. 2, 3, 4, 5, 6 and 7 gradually cut out or short-circuit the choking coils and entirely short-circuit the rotor windings, the motor in the meantime running up to a synchronous speed of 750 r.p.m., which is half-speed. It may be left running at this speed for any period of time operating with good efficiency as an ordinary induction asynchronous motor. On contact No. 8, by reference to the connections in the controller, it will be seen that voltage and current are supplied directly to the rotor windings, but as the rotor speed is then only 750 r.p.m., the current flows through the choking coils, which are gradually short-circuited by turning the controller from No. 8 to No. 14 contact. The rotor then runs up to a speed of 1500 r.p.m., because the current sent to the rotor windings produces a revolving magnetic flux which turns in the direction marked *T* in the circle diagram, so that the magnetic action then taking place between the two primary members—that is, the rotor and the stator—compels the rotor to travel at a speed of 1500 r.p.m., while, at the same time, it runs "synchronously" and with the maximum of magnetic and electrical efficiency. Assuming that the total power of the motor is, say, 20 hp, then half the power input is taken by the stator and half by the rotor. The stator winding occupies only the space of a 10-hp winding, while the rotor occupies a like amount. The tooth depth is reduced, the stator and rotor heat losses are diminished, and the outside diameter is lessened for a given air-gap diameter and stated rating by reason of the fact that the pole-pitch span is less, quite apart from the reduction in extra iron permitted by the reduction in the space required for the winding in both stator and rotor. Being wound with eight poles for 1500 r.p.m. and 50 cycles instead of four poles, as is usual, the starting torque is high for the energy input.—London *Electrician*, Nov. 7, 1913.

Direct-Current Armatures.—J. KÜNTZIGER.—A mathematical paper on the calculation of the dimensions of direct-current armatures. The author first gives some general formulas relating to the principal dimensions. They concern the cooling surface, the form of the pole pieces, the total weight, the reactance voltage, the ohmic drop and the armature reaction. These formulas are then applied to the calculation of the dimensions of armatures, both bi-polar and multi-polar machines being considered.—*La Lumière Elec.*, Nov. 1, 1913.

Lamps and Lighting

Modern Electric Lamps.—B. MONASCH.—An English translation in abstract of the author's recent report before the German Association of Electrical Engineers, which has already been noticed in the *Digest*.—London *Electrician*, Nov. 7, 1913.

Drawn Tungsten Filament.—A note on a recent British patent (No. 22,548, 1912) of Pope's Electric Lamp Company and C. Trenzen, of Germany. The filaments are drawn in the cold and without previous mechanical treatment from a sintered mixture of tungsten and thorium or some of their salts. The resistance of the filament is 20 per cent less than the resistance of a similarly made pure-tungsten filament.—London *Elec. Eng'ing*, Nov. 6, 1913.

Alternating-Current Flame-Arc Lamps.—A note on a recent British patent (No. 28,122, 1912) of the British Thomson-Houston Company and the General Electric Company of America. The lamp is fed from an auto-transformer which is normally unsaturated, but when the arc resistance exceeds a certain amount the transformer becomes saturated and cannot supply the energy to maintain the arc. The latter is, therefore, extinguished and then re-made by a series magnet in the secondary circuit of the auto-transformer, which actuates the electrode feed.—London *Elec. Eng'ing*, Nov. 6, 1913.

Neon Tubes.—GEORGES CLAUDE.—A brief paper on the

effect of the diameter of neon luminescent tubes on the potential difference at their terminals.—*La Revue Elec.*, Oct. 17, 1913.

Generation, Transmission and Distribution

Value of Coal.—E. Boernstein.—In order to determine the value of a given coal it is necessary to know, above all other things, the ratio of water and ash to carbon and the calorific value. The available testing methods are exact and reliable. Sampling is of greatest importance. In the case of a given installation a heating test using a large quantity of coal should be carried out.—*Elek. Zeit.*, Nov. 6, 1913.

High-Speed Machines.—T. Pausert.—A review of two recent papers by Maurice Le Blanc. In the first a design of steam turbines with a single wheel running at 30,000 r.p.m. is dealt with. The second discusses the design of a gas turbine operation at a speed of the same order.—*La Revue Elec.*, Oct. 17, 1913.

Sugar Industry.—W. S. Scott.—An article on electric motor drive in the beet-sugar industry, with diagrams of load-curves in typical sugar plants and figures for the individual power requirements of different sugar machines.—*Elec. Journal*, November, 1913.

Printing Motors.—An illustrated description of alternating-current commutator motors for printing-press work, with diagrams giving results of tests.—London *Electrician*, Nov. 7, 1913.

Traction

Norwegian Railways.—An abstract of a report of the Norwegian Waterfall Commission on the electrification of the Norwegian electric railways. At present 2976 km (1786 miles) of Norwegian railways are in operation and 3533 km (2120 miles) more are projected. The maximum power required for the railways now in operation would be 85,600 kw and the yearly energy consumption 118,000,000 kw-hr. For the projected railways these figures would be, respectively, 89,200 hp and 100,000,000 hp-hr. per year. The Norwegian state owns at present twenty-nine waterfalls, which can furnish 108,250 kw without regulation of the water and 542,000 kw if reservoir construction is resorted to. Thirteen of these waterfalls, with an aggregate capacity of 54,500 kw, have been acquired by the government especially for railway electrification. The transmission lines are intended to furnish energy also for other power purposes. The calculations show that it would be too expensive to erect only one power plant. The Nore power plant had been projected with eleven 14,750-kw turbines and two 7400-kw turbines. On account of reduced expense and for the sake of reliability several power plants are now considered preferable. It is recommended that the electrification of the railways be carried out gradually. As an experiment, at the beginning the line from Christiania to Drammen is to be equipped electrically.—*Elek. Zeit.*, Nov. 6, 1913.

Single-Phase Traction.—The first part of a fully illustrated description of the Spiez-Brig single-phase railroad in Switzerland, which includes the Loetschberg tunnel and is on the direct line connecting Paris with Milan. Single-phase, 15-cycle current at 15,000 volts is used on the trolley wire. The locomotives have a capacity of 2500 hp for an hour and a half at a speed of 50 km (30 miles) an hour. The article is to be continued.—*Elek. Zeit.*, Nov. 6, 1913.

Installations, Systems and Appliances

Correct Connections for Three-Phase Induction Motors —E. Richter.—The normal connections between a three-phase induction motor and its controller and the three-phase supply mains are shown in Fig. 2. If the connecting wires between controller and motor are placed in iron conduit, care must be taken either to run all the wires in one tube or to put three in one tube and three in another tube in such a way that at any moment the sum of the currents in each tube is equal to zero. In order to fulfil this condition the conductors from the contacts 3, 5 and 6 must be placed in one tube and the conductors from the contacts 1, 8 and 10 must be placed in the other tube. In making the installation the mistake is repeatedly made of putting the conductors from contacts 1, 3 and 5 into one tube and the conductors from 6, 8 and 10 into the other

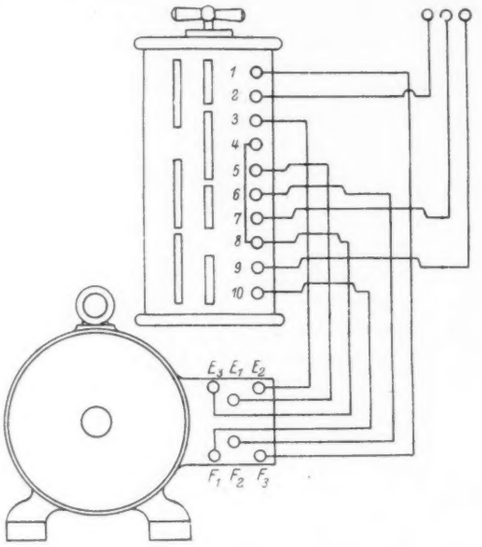


FIG. 2—CONNECTIONS FOR THREE-PHASE INDUCTION MOTOR

tube. While in this case the connections of phases 1 and 3 are correct, the connections of phase 2 are not correct, since the conductors which carry the current to this phase are in different tubes. They form, therefore, a loop which must result in a magnetic flux in the iron conduit. Consequently the effect is a choking of the emf of phase 2. The longer the connections between the controller and the motor, the less work will be done by phase 2, so that the two other phases are liable to be overloaded.—*Elek. Zeit.*, Oct. 30, 1913.

The "Point Fives."—A long editorial on the policy of the "point fives." Any station engineer is eligible to be a member of this association "if he includes a charge of 0.5d. (1 cent) per unit as a distinctive portion of his tariff. This is the sole article of faith and is one which permits a very wide variation." The idea is apparently sometimes held that a "point five" sells electrical energy simply at 0.5d. per unit for certain purposes. This is by no means the case. Indeed, generally speaking, it is not the case at all, and the average price obtained is considerably more than 0.5d. "The important point is that the consumer, having pledged himself to a certain definite expenditure per annum, is free to take as much energy as he desires at the low rate of 0.5d. per unit." The domestic consumer requires electrical energy first for lighting and second for heating and cooking These two services are very dissimilar. They can be kept distinct by installing two meters and having separate wiring throughout. But it is much easier to adapt the rates to meet the case. The recent extended discussion between the "point fives," represented by J. H. Bowden, and the opposition, represented by A. N. Moore, is summed up. In the same issue considerable information is given on the different rate schedules used by the "point fives" in different cities. The effect of electric heating and cooking on the station load is shown in a series of interesting load-curves for the St. Marylebone station. —London *Electrician*, Nov. 7, 1913.

Electric Heating and Cooking.—Illustrated articles giving a review of the present status of electric cooking and heating apparatus with special reference to water-heating. —London *Electrician*, Nov. 7, 1913.

Electrophysics and Magnetism

Where Ohm's Law Does Not Hold.—W. F. G. SWANN.—An illustrated paper on a case of anomalous conduction in a solid dielectric. The author's experiments have to do with the natural conductivity of paraffin wax when under the influence of no external agency except the electric field responsible for the current, and suggest that Ohm's law is not obeyed, the conductivity increasing in fact with the field. The experiment was arranged in a new way to avoid difficulties due to the high potentials used and to bring into prominence any deviation from Ohm's law. The theory and possibilities of error due to a departure from the ideal conditions of the simple theory are fully considered, and it is shown that the only likely way of accounting for the results obtained is by the assumption of a departure from Ohm's law such as corresponds to an increase of the conductivity with the field. The reasons for discarding any explanation of the phenomenon as due to soakage are discussed, and the possibility of its explanation as the result of an increase in the ionization, due to the field, is examined and found untenable. Other methods of accounting for the phenomenon are also discussed, the most likely one being framed on the lines of a modification of the theory of metallic conduction proposed by Sir J. J. Thomson.—*Philos. Mag.*, October, 1913.

Electric Wind.—J. R. BOON.—An account of an experimental investigation on the effect of pressure on the electric wind from a discharging point. The author describes an improved apparatus for the measurement of the pressure of the electric wind from a point-plate discharge under different atmospheric pressures. The curves of wind-pressure p and the distance between the electrodes z agree in form at normal atmospheric pressure with those of other observers and cut the z axis at a distance z_0 from the origin. The results at different atmospheric pressures P in air and CO_2 show that z_0 is proportional to $1/P$. This supports the view that z_0 is the result of intense ionization possibly brought about by radiations from the point, which are absorbed in a given gas according to a density law.—*Philos. Mag.*, October, 1913.

Residual Dielectric Forces.—K. W. WAGNER.—An article illustrated by diagrams developing a simple mathematical theory of residual dielectric forces (residual charge, dielectric energy losses, etc.).—*Elek. Zeit.*, Nov. 6, 1913.

Longitudinal Thermomagnetic Potential Difference.—A. W. SMITH.—An account of an experimental investigation, the chief results of which are as follows: The longitudinal thermomagnetic effect in bismuth decreases with rising temperature and seems to vanish at the melting point of the bismuth. Longitudinal thermomagnetic effects in graphite and monel metal were also determined by the author. The effect is positive in graphite and negative in monel metal. The longitudinal thermomagnetic potential difference in bismuth-antimony alloys shows a maximum value when the alloy contains about 9 per cent of antimony.—*Phys. Review*, November, 1913.

Electrochemistry and Batteries

Structure of the Atom.—SIR J. J. THOMPSON.—It is usual to regard Planck's equation as an indication that radiant energy is molecular in structure. The present author has already suggested that the same result would follow, without any such assumption as to the character of radiant energy, if the mechanism in the atom by which the radiant energy is transformed to kinetic energy were such as to require the transference to the mechanism of a definite amount of energy, sufficient, for example, to rupture some system before the transference can take place. Planck's relation, in fact, depends on the properties of the atom, the agent by which the energy is transformed, rather than upon the existence of a structure in the energy itself. In the present paper the author describes an atom of such a kind that the transformation of radiant into kinetic energy would take place in accordance with Planck's law. The forces acting on a corpuscle in an atom are assumed to be as follows: (1) a radial repulsive force, varying inversely as the cube of the distance from the center, diffused throughout the whole of the atom and combined with it; (2) a radial attractive force, varying inversely as the square of the distance from the center, confined to a limited number of radial tubes in the atom.—*Philos. Mag.*, October, 1913.

Units, Measurements and Instruments

Integrating Methods in Alternating-Current Testing.—FRED. BEDELL.—An abstract of an American Physical Society paper. An alternating current or voltage can be measured by a direct-current instrument or galvanometer of the D'Arsonval type if a synchronous commutator is interposed between the circuit and the instrument. The reading of the instrument is the integral of the alternating current for one-half cycle, the limits of the integral being determined by the setting of the brushes on the commutator. The brushes may be shifted so as to shift the half cycle over which the integral is taken. In this way successive instantaneous values may be found of one quantity the value of which depends upon the integral of the quantity directly measured. For example, if the quantity measured by means of the commutator and galvanometer is the current flowing in a condenser, the successive readings of the galvanometer are proportional to the instantaneous values of the charge q of the condenser, since $q = \int idt$. The integral readings of condenser current for any setting of the brushes gives the instantaneous value of q at the moment of commutation. Since the potential v is proportional to q, this gives a method for determining the wave-form of potential. If the potential is taken across the terminals of a non-inductive resistance, the wave-form of current is determined. This condenser-current method for determining wave-form is much more sensitive and has a much wider range than various time-honored point-by-point methods. In this and in other integrating methods variation in commutator resistance may be a source of error which may be reduced by perfecting the apparatus or may be made ineffective by choice of method.—*Phys. Review*, November, 1913.

Measurement of Magnetic Fields by Their Damping Effect Upon a Vibrating Coil.—P. E. KLOPSTEG.—The author derives an equation for the intensity of a magnetic field in terms of quantities readily obtainable by observations upon a suspended coil vibrating in the field with damped periodic motion. He also derives a similar equation depending upon critical damping, and an application of the term "logarithmic decrement" to critically damped motion of a moving coil. These equations are experimentally verified, and it is shown that the method depending upon damped periodic motion may be applied with an accuracy of at least 1 per cent to the measurement of fields ranging from a few lines to at least 1500 lines per sq. cm, using the same coil over the entire range.—*Phys. Review*, November, 1913.

Low-Resistance Silver-Quartz Fibers.—H. B. WILLIAMS.—An abstract of an American Physical Society paper. Low-resistance quartz fibers suitable for use in the Einthoven galvanometer and similar instruments are usually prepared by chemical silvering. Such deposits are rough and the amount of silver is high in proportion to the conductivity. Cannegieter has shown that smooth fibers can be produced by deposition of a cathode film, followed by electroplating. By the method here outlined fibers of low resistance can be obtained by the cathode spray alone, thus diminishing the number of manipulations and avoiding all contact with chemical solutions. The cathode is of pure sheet silver bent to a half cylinder. The fibers are held in the discharge tube on a glass frame to which they are cemented with hot shellac. The tube is several times ex-

hausted to 0.01 mm and rinsed with dry electrolytic hydrogen. Discharge is maintained at 0.01 amp with a potential of from 1200 volts to 1500 volts. Direct current is supplied by two small generators with armatures connected in series and fields separately excited. Much gas seems to be occluded during the discharge and a small stream of hydrogen is allowed to leak in steadily, maintaining the current constant. The time of discharge varies with the thickness of film desired. A fiber 140 mm long, 0.002 mm in finished diameter, and having a resistance of 2700 ohms, was obtained by exposure for three hours. The fibers are microscopically smooth and the coating is very compact, uniform and strongly adherent. A liquid air block between the discharge tube and the other parts of the apparatus insures uniform success, but good results can sometimes be secured without it.—*Phys. Review,* November, 1913.

Determining the Horizontal Intensity of the Earth's Magnetic Field.—Walter A. Jenkins.—A description of a new method for determining the horizontal intensity of the magnetic field of the earth. The principle of the method is the production of a known field opposite to that of the earth's and twice its magnitude. The equality of the two fields—that due to the earth and that due to the combination of the earth's and the produced one—is determined by the equality of the times of vibration of the same magnet, when the applied field is off and on. The applied field is determined by measuring the current producing it. This method is as accurate as the old familiar one and has the great advantage of involving no corrections.—*Philos. Mag.,* October, 1913.

Cathode-Ray Oscillograph.—H. H. Broughton.—For teaching purposes it is claimed that the cathode-ray oscillograph is convenient and practical. Full particulars of the construction and operation of the instrument are given, and in conclusion a number of interesting experiments adapted for elementary students are described.—London *Electrician,* Nov. 7, 1913.

Testing of Alternating-Current Machinery.—This continuation of the long illustrated serial on shop testing of electrical apparatus deals with alternating-current generators and synchronous motors and relates to mechanical inspection, polarity, resistance, core loss, separate driving motor method, friction and windage, currents in bearings, short-circuit loss and impedance, no-load saturation, full-load saturation at approximately zero power factor, locked saturation, starting tests for synchronous motors, torque tests and the regulation of alternating-current generators. —*Elec. Journal,* November, 1913.

Telegraphy, Telephony and Signals

Telegraph Transmission Over High-Tension Lines.—M. Meyer-May.—An illustrated paper describing a telegraph system recently installed on a 45,000-volt transmission line. The power-transmission circuit itself is utilized. No special source of energy is required for the telegraph system, nor is there any danger for the attendants. Operation is based on the potential difference between the isolated neutral points and earth. Normally this potential difference is zero. But if at a point of one phase an earth connection is made for a moment through a resistance, the potential difference in question assumes a certain value and an electrostatic balance is thereby effected. The details of the system are shown in a series of diagrams.—*La Revue Elec.,* Oct. 17, 1913.

Miscellaneous

The Vocation of Electrical Engineer.—E. W. Merchant. —An abstract of his inaugural address to the Manchester Section of the (British) Institution of Electrical Engineers. The speaker considers the prospect for electrical engineers to be good. "The supply hitherto has been ample, the demand meager; now demand is overtaking supply, and the necessary consequence of an increased demand is either a worse quality of product or a higher price. It is to be hoped that the members of this institution who have it in their power will see to it that it is the latter alternative that is chosen by the electrical engineering industry."—London *Electrician,* Nov. 7, 1913.

British Institution of Electrical Engineers.—An article on the opening of the season. The policy of the "broader view," inaugurated by Ferranti, by which greater attention is to be paid to the non-technical interests of the Institution is to be maintained. This point was emphasized in a speech by the president, Mr. William Duddell. The chairmen of the local sections are Messrs. A. M. Taylor, Birmingham; Charles Vernier, Newcastle-on-Tyne; William B. Woodhouse, Yorkshire; H. Faraday Proctor, Western local section; J. A. Robertson, Scottish local section; E. W. Marchant, Manchester, and G. W. Harriss, Dublin. Biographical sketches and portraits of most of them are given.—London *Elec. Review,* Nov. 7, 1913.

Presidential Address.—H. Faraday Proctor.—His presidential address to the Western Section of the (British) Institution of Electrical Engineers in Bristol. He first deals with the training of engineers and says: "It is desirable that the boy be first a gentleman; secondly, make him into a man, and thirdly, into an engineer." When the 1-watt lamp came to the fore, there was doubt in the minds of many as to its probable effect upon the sale of electricity. In 1909 a careful comparison was made of the consumption of electricity by a number of Bristol consumers who had installed 1-watt lamps throughout their premises with the consumption of the same consumers when using carbon-filament lamps. Care was taken to ascertain that the results were directly comparable, and the returns showed that the consumers increased the candle-power installed on the average about 50 per cent. With the advent of the new "half-watt" lamp the author thinks that a similar result will again be obtained. Attention must be paid, however, to the cost of running new services and to pushing electric cooking and water heating.—London *Electrician,* Oct. 31, 1912.

Book Reviews

The Science of Illumination. By Dr. L. Bloch. Translated by W. C. Clinton. New York: D. Van Nostrand Company. London: John Murray. 180 pages, 57 illus. Price, $2.50 net.

This volume is a good translation from German into English of the original book by Dr. L. Bloch entitled "Grundzüge der Beleuchtungstechnik," with, however, a number of judicious and useful additions in detail, which add to the serviceability of the English version. The chapters, to the number of six, are devoted to the following topics: Fundamental units in illumination, measurement and calculation of candle-power, estimation of illumination, measurement of illumination, indirect lighting.

Die Deutschen Überland-Zentralen und Ihre Wirtschaftliche Bedeutung als Kraftquelle für den Kleinbetrieb in Landwirtschaft und Gewerbe. By Dr. Walter Straus. Berlin, Germany: Franz Siemenroth. 208 pages, illus. Central-station charts. Price, 7 marks.

A statistical inquiry into the economic conditions of generating stations and electrical development in modern Germany, with a map showing the location of the stations and their regions of influence. The four chapters of the book relate to the following subjects: German central stations and the directions of their development; comparison between electric motors with small engines; the economic importance of electric distribution in farming and in industry; résumé. A large amount of statistical material is presented.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Electric Calculating Machine

The electric calculating machine made by the Ensign Manufacturing Company, Boston, Mass., and illustrated herewith, is designed to multiply, divide, add, subtract and extract square and cube roots. Power is obtained from a 1/12-hp Holtzer-Cabot motor which winds a large spring through a worm-gear and shaft connection. In order to

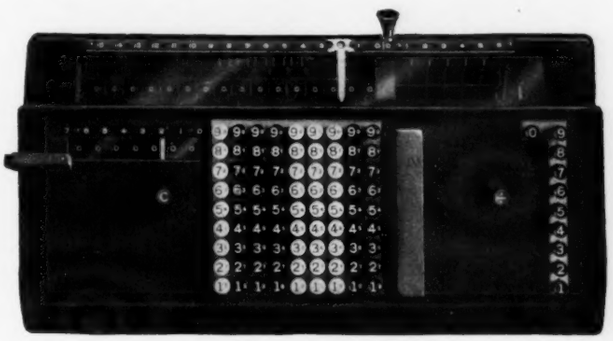


FIG. 1—KEYBOARD FOR ELECTRICALLY OPERATED CALCULATING MACHINE

wind the spring slowly so that the tension of the spring shall be kept constant, a twenty-to-one reduction is made in the worm gear with a further reduction by means of a small pinion in the circular spring box. The operating device is so arranged that the motor will wind the spring while the calculating mechanism of the machine is unwinding.

The energy supply to the motor is regulated by a snap switch which opens the circuit when the spring reaches a predetermined tension and closes it again when the spring becomes partially unwound. To further regulate and control the actual working speed of the machine a centrifugal governor is connected to the shaft. All shafts and bearings are of the roller type and are hardened and polished.

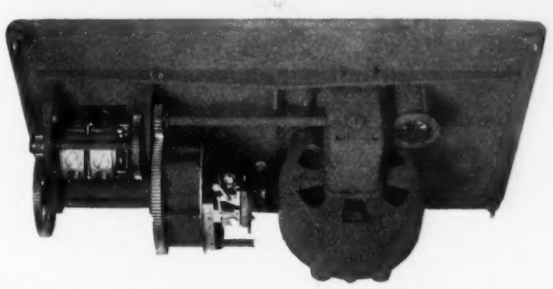


FIG. 2—MOTOR AND OPERATING MECHANISM FOR ELECTRIC CALCULATING MACHINE

A tubular-steel stand equipped with castors is furnished with the machine so that it can be moved easily from place to place. The motor and operating mechanism, shown in Fig. 2, are hung from beneath the keyboard seen in Fig. 1. The machine is designed to multiply 1 by 1 as well as 999,999,999 by 9,999,999 and any combination of figures between these amounts.

Radial-Flow Reaction Turbine

The Brush Electrical Engineering Company, Ltd., London, England, has recently taken up the manufacture of a radial-flow reaction steam turbine designed by Messrs. Birger Ljungström and Fredrick Ljungström, of Stockholm, Sweden. Steam is admitted between two disks and in its travel from their center to the circumference passes between concentric blading rings carried alternately by the two disks. Both disks revolve, driving their shafts at equal speeds but in opposite directions. To each shaft is coupled an electric generator, and at the end of one of the generator shafts is mounted a small exciter for the fields of both machines.

Fig. 1 shows a 1000-kw Brush-Ljungström turbo-generator mounted on a condenser. The lower half of the tur-

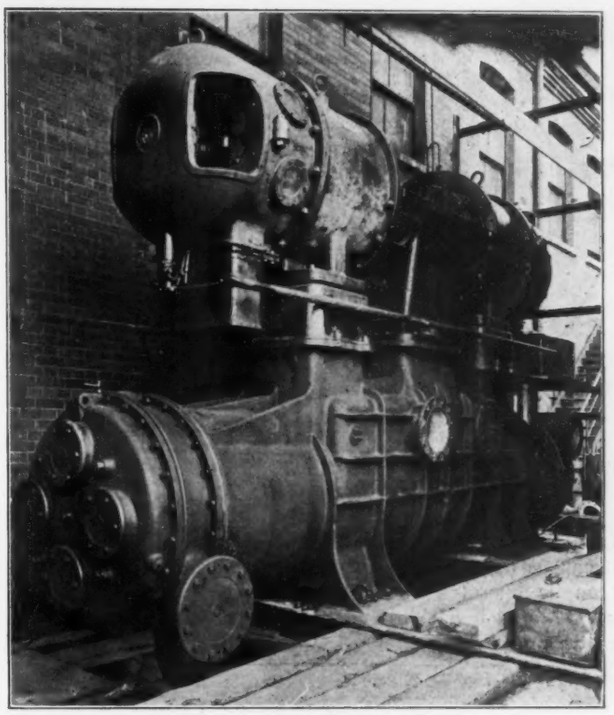


FIG. 1—1000-KW BRUSH-LJUNGSTRÖM TURBO-GENERATOR SET

bine casing is formed into an exhaust branch, which is bolted directly to the condenser beneath. Springs contained in cast-iron boxes support each generator. The turbine shafts themselves have no bearings; but each is fastened by means of a flange connection to its own generator shaft, the bearings belonging to the latter.

The turbine is very small, considering the amount of power developed, being only 27.75 in. in diameter and 20.875 in. long. Each turbine shaft is about 10.5 in. long, and the weights of the two running disks complete with blading are 265 lb. and 303 lb. respectively. In Fig. 2 is shown a 1000-kw set with the turbine removed. The two branches of the Y steam pipe can be clearly seen in this illustration.

Each turbo-set is provided with a steel cable held under

tension which holds shut an oil relief valve actuating the stop-valve and by means of which the machine can be stopped either automatically by the melting of a fusible metal plug in any of the bearings or by hand with a small lever at the stop-valve. In case this cable breaks, gets loose or is released by the overheating of any of the bearings, the turbine is automatically shut down. An excess-speed device on each generator shaft will also release the cable and cause the machine to stop.

The whole of the turbine is surrounded by exhaust space, so that there is no need, therefore, of lagging the surface of the casing, the temperature of which never exceeds that of the condenser. The absence of a split-iron casing eliminates distortion troubles, and consequently a higher superheat is practicable than is the case with the ordinary reaction turbine.

After "warming up" the machine for about ten minutes the full speed of 3000 r.p.m. can be obtained. When the speed rises to about 1400 r.p.m. the exciting current becomes strong enough to cause the two generators to synchronize themselves automatically and thereafter run electrically as one machine. The automatic synchronization of the machine can be seen by watching the behavior of the switchboard instruments. The fields of the two units are connected in series so that only a single field rheostat is

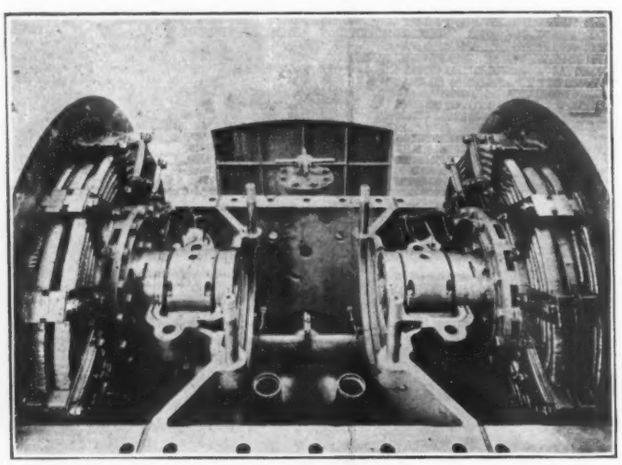


FIG. 2—1000-KW BRUSH-LJUNGSTRÖM SET WITH TURBINE REMOVED

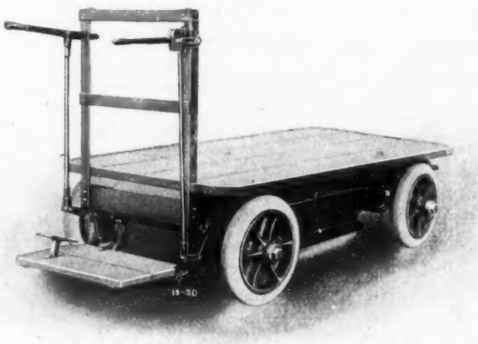
needed. In case one of the generators becomes disabled, it can be bolted to the casing and the other generator can then be operated alone, the result being a reduction in output by one-half and a higher steam consumption per unit.

Storage-Battery Industrial Truck

The industrial truck shown in the accompanying illustration has been designed by its maker, the C. W. Hunt Company, Inc., New York City, for conveying heavy material about manufacturing plants, shops and railroad terminals. For this use the truck can be operated with considerable flexibility since its size permits it to be run onto elevators and into box-cars with ease.

The carrying capacity of the truck is approximately 4000 lb., and with this load its maximum speed is 5 miles per hour. The storage capacity of the batteries is ample for an ordinary full day's working. Either Edison nickel-iron cells or "Exide" lead cells can be supplied. The battery is incased in a heavy steel box suspended by springs from the cross-members of the frame. The entire section over the battery box is removable, making the batteries readily accessible.

The motor has been specially designed for commercial-vehicle service and drives the wheels through a differential of cut-steel gearing inclosed in an oil-proof and dust-proof housing. Ball and roller bearings are used throughout. The operator's platform is at the front. The truck is steered by the right-hand lever, while the other lever con-



STORAGE-BATTERY TRUCK

trols the motor. The brake is actuated by the foot pedal, which is shown in the illustration. When not in operation the truck is always locked.

Coasting Time Recorder

The Rico coasting-time recorder is an instrument for use on electric cars and multiple-unit trains recording the actual number of minutes of operation without the application of energy or brakes. It reads in "coasting minutes" and delivers a printed voucher slip to the motorman at the end of each run, showing the degree of economy he has been exercising.

The recorder consists of a recording mechanism and an electric relay. The printing mechanism is driven by a double-spring marine-movement clock designed to withstand excessive vibration and climate changes.

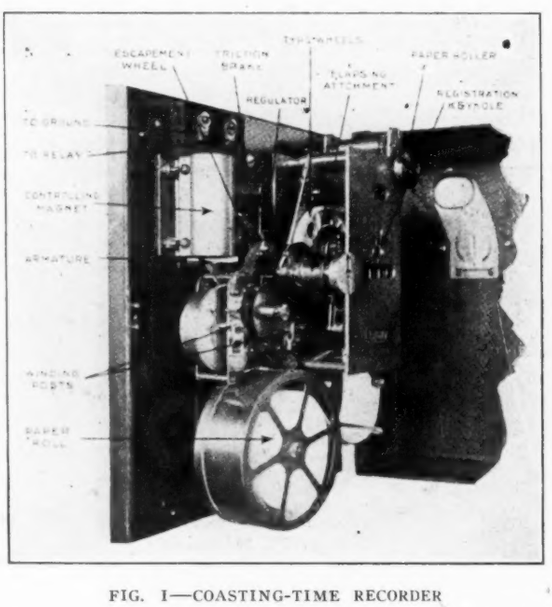


FIG. 1—COASTING-TIME RECORDER

The controlling magnet on the clock movement is energized only when the traction motors are running as generators, but when the controller is "on" no current can possibly get through to the clock magnet from the traction motors. When the brakes are applied the clock circuit is

opened. Thus it is impossible for a motorman to "coast to a standstill" and obtain a fictitious record, for the energy which operates the clock magnet ceases when the motor stops.

The relay is inclosed in a substantial steel case and can be

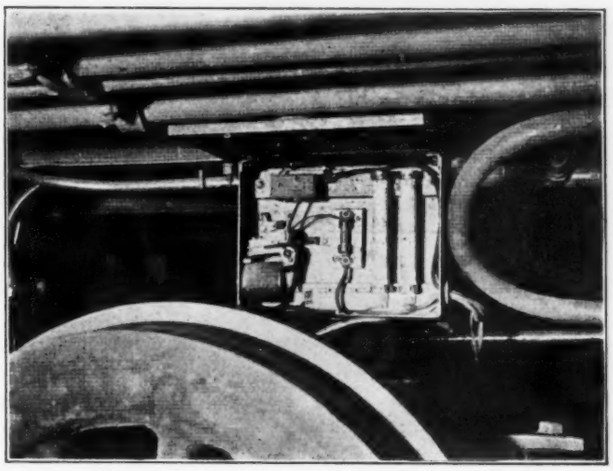


FIG. 2—COASTING-TIME RECORDER MOUNTED UNDER ELECTRIC CAR

locked or sealed as desired. On straight air-brake cars the relay is installed at any convenient place. These instruments are marketed by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., and they are designed particularly for equipment put out by this company.

New Recording Hygrometer

A new recording hygrometer has been designed and put on the market by the Industrial Instrument Company, Foxboro, Mass. By means of this instrument both dry-bulb and wet-bulb temperatures can be recorded simultaneously and continuously for twenty-four hours on the same chart, the two records being kept independent of each other.

The instrument consists of two sensitive helical-tube bulbs mounted in tandem as shown in Fig. 2. The tube *B* is the dry bulb, which records the temperature of the surrounding air, and the tube *C* is the wet bulb, which is covered with a special jacket leading down into the trough

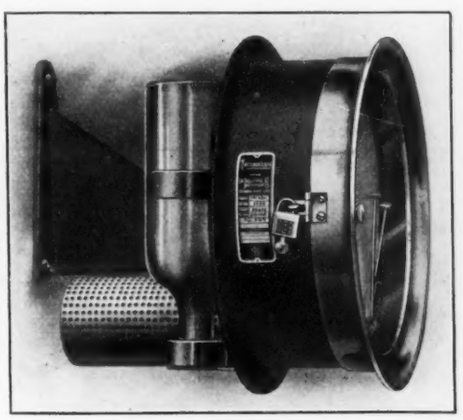


FIG. 1—RECORDING HYGROMETER

D. The tube *C* is always cooler than *B* on account of the water being evaporated. This evaporation increases or diminishes in proportion to the amount of moisture in the air. The pen arms are attached directly to the shafts concentric with the bulbs. Taking the difference between the two records made by the pens and referring to a table which accompanies the instrument, the relative humidity can be quickly ascertained. The case is mounted on a swivel at right angles to the wall or support, giving easy access to the inverted glass bottle *A*, which serves as a

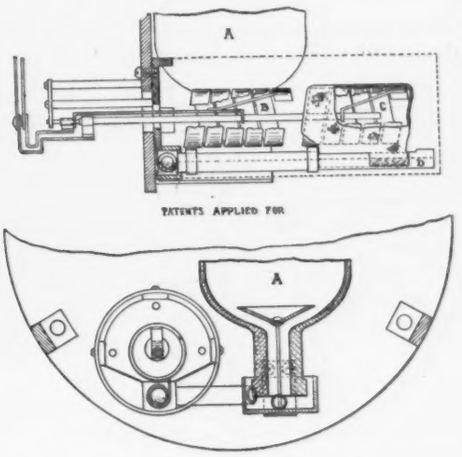


FIG. 2—TRANSVERSE SECTION AND CROSS-SECTION OF HYGROMETER

water reservoir. The hygrometer is made in 8-in., 10-in. and 12-in. sizes and will record temperatures varying from 0 deg. C. to 100 deg. C.

Electrically Operated Motion Sign

The feature of the electrically operated motion sign illustrated herewith is its changing display space on which appear in succession four different legends. The apparently unbroken display surface is made up of a set of pivoted prisms, each carrying a folding leaf. As the prisms are slowly rotated by a small electric motor, different lines of advertising are brought successively to the front. During each change a flasher mechanism geared with the operating motor switches on electric lamps behind the various colored bulls'-eyes, attracting attention to the display. When the lettered surfaces are in fixed position the sign is automatically illuminated with white light from the frosted lamps shown. Any number of prisms of any desired size

FIGS. 1 AND 2—MOTION SIGN REVOLVING AND IN POSITION FOR READING

may be used, and reading matter may be quickly changed by substituting new prisms. Mr. J. H. LaPearl, of Los Angeles, Cal., originated this motion sign, which is being manufactured by the Day & Night Sign System, of Los Angeles.

Nitrogen-Filled Incandescent Lamp

The Allgemeine Elektricitäts Gesellschaft, of Berlin, Germany, has developed a nitrogen-filled incandescent lamp which is the culmination of experiments carried on simultaneously, although independently, with those of the General Electric Company described by Dr. Irving Langmuir before the A. I. E. E. meeting at New York, Oct. 10.

Similar results were obtained by the two companies.

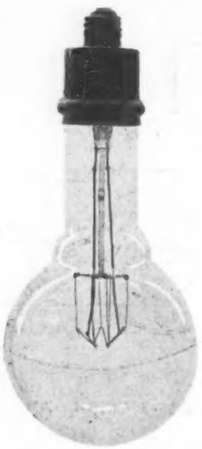


FIG. 1—NITROGEN-FILLED LAMP WITHOUT REFLECTOR

The German investigators have found that filling the bulb with gas prevents the rapid evaporization of the filament, while compression of the latter into the smallest allowable space is a change essentially necessary for a lamp of higher lighting efficiency. The filament of this German "Nitra" lamp is wound in a narrow spiral and in this respect is similar to that brought out by the General Electric Company.

The Nitra lamps illustrated herewith are much smaller than the high candle-power incandescent lamps heretofore used. The globe of the 2000-cp lamp, for example, is smaller than that of the old 1000-cp lamp, being 7.87 in. in diameter instead of 9.45 in. The neck is made longer in order to serve as a cooling and condensing chamber for the gas and the evaporated particles led up from the filament

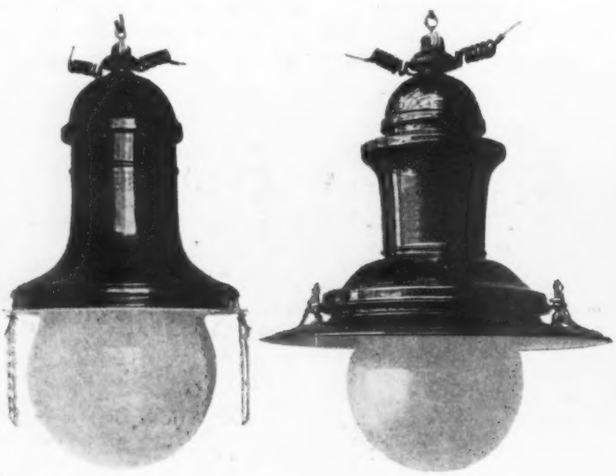


FIG. 2—NITROGEN-FILLED LAMPS EQUIPPED WITH REFLECTORS

and deposited on the glass. The lower part of the globe therefore remains clear even after long burning. On account of the larger amount of heat developed in the nitrogen-filled lamp, the socket and holder are placed at some distance from the filament to prevent their becoming excessively heated. The socket is fastened to the glass mechanically so that it cannot be loosened; the lamp, consequently, will not fall in case the cement breaks up as the result of long life.

The Nitra lamp has no glass tip. The bulbs are filled with nitrogen at an absolute pressure of approximately 9 lb. per sq. in. The spiral filament can be placed in various positions according to the light distribution desired, and its compact arrangement makes it very satisfactory for projectors and search-lamps.

The Nitra lamps is so dimensioned that it has a consumption of 0.5 watt per mean lower hemispherical cp with a clear-glass globe and no reflector. This corresponds to an average light intensity in a room of 0.5 watt per cp. By employing suitable external reflectors, the consumption of 0.5 watt per cp can be subjected to a further reduction if this is deemed desirable.

"Eyeball" Search Lamps for the Motor Car

In the host of electrical accessories developed in connection with automobile work, one of the most curious and at the same time useful devices is an electric lamp made by Mr. E. Cannevel, of Levallois-Perret, France. The illustrations show the method of mounting this lamp in the motor-car body, revealing resemblance to the eyeball and

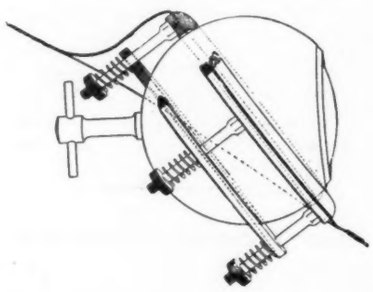


FIG. 1—MOUNTING OF "EYEBALL" SEARCH-LAMP

its orbital socket from which the lamp, of course, takes its name.

Owing to the spherical form of this lamp, its projected beam can be turned at will through an angle of about 80 deg. in both the horizontal and vertical planes. By means of small clamps it can then be locked in any position. The lamp can thus be used as a search-lantern for reading

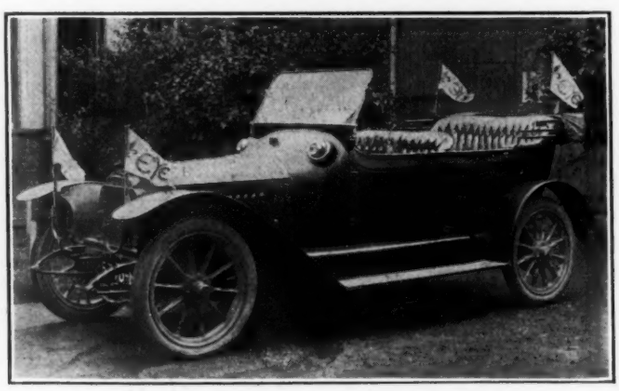


FIG. 2—AUTOMOBILE EQUIPPED WITH "EYEBALL" SEARCH-LAMPS

signposts, mileposts, etc., while if required the shell can be taken directly out of its socket and used to investigate trouble under the car or in the engine. A handle is fitted on the "eyeball" by which the driver, after loosening the milled-head nuts which form part of the clamping device, can turn the eye in any direction.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Electric Vehicle Makers Arrange to Continue Operations.—Rumors which have circulated as to the financial embarrassment of the Standard Electric Car Company, of Jackson, Mich., were not denied in a circular sent out recently by that concern, but it was stated that arrangements have been made for continuing the business and that new capital for this purpose has been secured. The Standard Car Manufacturing Company has been organized to operate the business of the above company, but no changes in management organization are proposed. Legal obstacles in the way of the reorganization have been removed and the company claims that the new capital available will enable it to continue operations on a satisfactory basis. It says further that at the present time it has about 400 cars in the hands of satisfied customers. This firm's specialty is a popular-priced electrical coupé.

Prominent Automobile Manufacturer on General Business Outlook.—Addressing the St. Louis Business Men's League recently, Hugh Chalmers, president of the Chalmers Motor Company, of Detroit, expressed the opinion that the coming year would be marked by business prosperity. Referring to the attitude of the present administration, as reflected in the currency measure, he said: "After a recent talk with Mr. Redfield, Secretary of Commerce, as to the condition of business throughout the country, I am satisfied that the administration's attitude toward business is a very fair one and that it wants to help us all it can. We are now hearing from a great many sources that calamity will follow the passage of the currency bill. I do not believe that calamity will follow its passage, and if it does it will not be due to the bill, for the chances are that when the bill does pass it will be a good one and one that every banker in the country will be willing to accept and give a fair trial."

Growth of Electric-Service Business in Mobile.—Since passing under the management of H. M. Byllesby & Company in 1906 the Mobile (Ala.) Electric Company has made an increase of 157 per cent in output of electrical energy. This has been accomplished with an approximate increase of 18 per cent in population and 53 per cent in number of customers. The company is the result of the combination of two companies engaged in competition before May, 1906. The following comparisons are made, the figures being as of May, 1906, and September, 1913: Number of customers, 4203 and 6595; kilowatts of lighting load connected, 4126 and 8397; connected motor load in horsepower, 1100 and 4522; total connected load in kilowatts, 4946 and 11,771. When the combination was effected in 1906 the weekly kilowatt-hour output was about 84,000, while for the week ended Nov. 15, 1913, it was 216,218. During the present year the company has installed new coal-handling and ash-handling machinery in its generating station.

Extending Trade with South American Countries.—Secretary Redfield of the Department of Commerce has appointed E. N. Hurley, of Chicago, president of the Hurley Machine Company, United States trade commissioner to South American countries. Mr. Hurley will go to Argentina and other countries in February with a party from the Illinois Manufacturers' Association. In giving his instructions to Mr. Hurley, Secretary Redfield laid stress on the desirability of developing commercial opportunities for the small as well as the large producer. Although the United States, he said, had made wonderful progress in acquiring foreign markets, it has been the large exporters who have reaped the harvest. "Our efforts will be devoted largely to investigating the problem of developing credit for American producers and exporters," Mr. Hurley said. "In this respect American manufacturers at present are decidedly at a disadvantage. When a German manufacturer discovers an opportunity of extending his trade in a foreign country he goes to a German bank for the money to finance his enterprise. The bank in going into the venture is backed by the German government and the band receives 25 per cent of the profits. I am opposed to this plan, under which the foreign business gets into the hands of the banks."

Westinghouse Electric Company's Safety Campaign.—In the prevailing effort of progressive manufacturers, transportation agencies and other employers of labor to adhere to the "safety first" principle, the electrical industries are not lagging behind. This campaign represents an endeavor to minimize the danger of accidents, to render all machines and appliances as nearly foolproof as possible, and to remedy conditions detrimental to health. In the extensive works of the Westinghouse Electric & Manufacturing Company, at East Pittsburgh, Pa., the department of safety, working in conjunction with other departments of the factory, has introduced a number of interesting, and in some cases novel, appliances to carry these ideas into effect. One of the new methods for stimulating interest in this work consists of the use of a suggestion box into which notes can be dropped by the employees, treating of any conditions which they think can be remedied and giving their suggestions for means to effect the remedies. This suggestion box scheme has been tried in all the shops of the above company and has been instrumental in pointing out and remedying many dangerous and faulty conditions. A reward of $5 is paid to the author of each suggestion adopted. This scheme might well be tried in other similar shops where the hazard of employment is large and its use would reduce claims for damages arising from accidents.

Importance of Obtaining Design Registration System.—A convention was held at the Hotel Astor in New York on Nov. 21 at which matters of primary importance to manufacturers in many branches of the electrical and other industries were discussed. In order to secure the exhibition of English and German products at the Panama-Pacific Exposition in San Francisco, in 1915, Congress has passed the Kahn act, which, if construed literally, is a direct menace to many American manufacturing interests, including those in several branches of the electrical industry. The fundamental purpose of this law is, however, an excellent one, and its opponents in attacking it are aiming at the same time to secure the introduction and passage of a federal design registration law which will fulfil the purpose of the Kahn measure and go a step further by providing for designs of various sorts the same protection which is now given to inventions by the patent laws and to writings and pictures by the copyright laws, familiar to everybody. A few of the electrical interests which are vitally affected by this movement are the makers of ornamental lighting posts, fixtures and glassware, household heating and cooking appliances, signs, vehicles, meters, lamps, fans and wiring supplies. The National Registration League, of Philadelphia, Pa., is making the fight for a design registration law, and co-operating with it are the Federation of Trade Press Associations of the United States, representing 271 leading trade papers throughout the country, as well as seventeen associations of business men to whose attention the matter has been called. Design piracy, as pointed out by one of the speakers at the above convention, is a force which tends to strangle all initiative and prevent all efforts to push business by advertising and sales publicity, and it is annually responsible for immense financial loss to the progressive firms in any line where trade designs have value.

British Field for American Electric Vehicles.—The extended use of electrical vehicles for pleasure and for commercial purposes is said to be receiving some attention at this time in the British Isles. The conviction seems to be growing there that cars of this type are the ultimate choice for urban service where frequent stops are necessary and the distances are comparatively short. The main objection to the electric car so far has been the fact that English manufacturers have failed to develop a satisfactory storage battery for use with it, but possible users are now beginning to realize that American cars can be obtained equipped with high-grade batteries. The movement toward the electric vehicle seems to have started with pleasure cars, and one British manufacturer has decided to devote a third of his plant to the making of this class of conveyances, equipping them with the Edison batteries. In the commercial field a number of large business houses have taken up the matter of electric-vehicle service with Edison batteries, and one of these has recently placed a trial order for four cars. The use of electric vehicles for ambulance, fire and central-station repair and delivery service is also being investigated, and it is thought that these cars will finally crowd out all other types for service where moderate speed and high economy are desired. In the introduction of the electric vehicle to the British trade there is necessity, however, for careful salesmanship and a study of British prejudices. The central-station interests are naturally very favorable to the growth of electric vehicle sales there and have promised to provide charging facilities as fast as the demand for them shall require. One central station has proposed to charge electric vehicle batteries between 12 midnight and 6 a. m. at a fixed rate, irrespective of the amount of energy drawn.

Prominent Engine Builders to Manufacture Diesel Engines.—Of unusual interest at this time is the announcement, just made, of the organization of the McIntosh & Seymour Corporation, chartered under the laws of the State of New York, to undertake on an extensive scale the manufacture of Diesel engines for both stationary and marine use. This company is backed by strong American interests and also to a large extent by Swedish capitalists who now control the Swedish Diesel Motor Company, which owns the patents covering the Hesselman type of Diesel engines. The plant and organization of the McIntosh & Seymour Company, of Auburn, N. Y., will be taken over by the new concern and the steam-engine business will be continued as heretofore. The initial capitalization of the new company is $2,200.000, half of it common and half 6 per cent cumulative and participating preferred stock. E. S. Church, formerly superintendent of the Akron plant of the International Harvester Company, is executive head of the corporation just formed, and J. A. Seymour, president of the McIntosh & Seymour Company, is vice-president in charge of engineering. The board of directors consists of Marcus Wallenberg, president of the Stockholms Enskilda Bank, Stockholm, Sweden; Frank A. Vanderlip, president of the National City Bank, New York; Thatcher M. Brown, of Brown Brothers & Company, New York; Edwin S. Church, Auburn, N. Y.; J. A. Seymour, Auburn, N. Y.; F. B. Kirkbride, New York City; Oscar Lamm, Stockholm, Sweden, and P. W. Henry, New York City. In addition to furnishing exclusive licenses for work under their valuable American patents, the Swedish interests in the new company insure their active aid and co-operation by furnishing a large part of the working capital and, furthermore, will take an active part in the actual building of the American engines. The McIntosh & Seymour Company, understanding thoroughly American conditions of manufacture, will produce an output suitable for American needs, as well as furnish a highly developed plant and organization adapted for the immediate production of Diesel engines on a large scale. This, together with the strong financial backing available, seems to assure the success of the new enterprise. The Swedish Diesel Motor Company started building engines of the Hesselman type in 1898. Many of their designs covering the most important features peculiar to the Diesel engine, such as the fuel pump, the atomizer and the piston details have been purchased and adopted by other leading European builders of Diesel engines. The McIntosh & Seymour Company has been engaged in the manufacture of high-grade steam engines in this country for many years and its engines are installed in a number of large and successful steam plants throughout the United States. It has also been active in exporting its product to various parts of the world. The move to introduce the Hesselman type engine into this country is in line with the general tendency at present among foreign makers of Diesel engines. Only a short time ago the American Krupp System Diesel Engine Company was incorporated in Delaware for the manufacturing and selling of the Krupp type engine in the United States, and previous to this event the Busch interests in St. Louis acquired the American rights to another German type of Diesel engine and laid plans for its fabrication and sale here. The principal claims made for this Swedish engine lie, as with other types of Diesel engine, in the advantages of cheap oil fuel. The field claimed for it is nearly as broad as for the steam engine and includes central stations, factory and isolated power plants, and railway service. It is said to be especially suitable for marine work, where economy of weight and space are of primary importance.

Copper Market Conditions as a Large Consumer Sees Them.—The National Conduit & Cable Company gives its views concerning the present condition of the copper market as follows: "The high crest of the copper market on the recent movement was reached a short time ago, and with a decrease in buying demand a readjustment in prices became inevitable. Domestic consumption has also receded from the high level of a few months ago, and it seems apparent to good judges of the situation that a further reaction in business is probable before satisfactory conditions in manufacturing lines are again established. It is not surprising, therefore, that present sentiment appears to favor the policy of buying on a hand-to-mouth basis. The weakness of the London market lately was especially remarked, and the heavy selling of future deliveries at that center influenced local buyers to hold off until the current uncertainty regarding prices and demand for the next six months required less caution. Although hesitation has become a prominent feature owing to recent developments in business prospects, we expect that this tendency will be only temporary, and with more settled conditions market activity will grow accordingly. With the situation so much confused it is not to be wondered at that the volume of business the last few weeks fell much below the normal. Strikes at mines and shut-downs at smelters helped for a while to keep copper market values high, but with more favorable conditions at producing centers there should be more liberal shipments available for consumption in the coming months. A miners' strike at the Michigan mines has seriously interfered with the production of Lake copper for nearly four months, but notwithstanding the fact that the Lake output for October was only about one-third the normal size there was an increase of 7,669,252 lb. in the total United States productions last month."

NEW YORK METAL MARKET PRICES

	Nov. 18 Bid.	Nov. 18 Asked.	Nov. 24 Bid.	Nov. 24 Asked.
Copper:				
Standard, spot*	.....	.....	.....	.....
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard, spot*	69 10 0		65 0 0	
Prime Lake	.....	.....	15.00	to 15.25
Electrolytic	15.25	to 15.37½	14.62½	to 14.87½
Casting	15.00	to 15.12½	14.50	to 14.62½
Copper wire base	16.37½	to 16.50	16.00	.....
Lead	4.35		4.35	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.50		7.50	
Spelter, spot	5.30	to 5.35	5.30	to 5.35
Tin, spot	40.05	to 40.50	39.25	to 39.65
Aluminum:				
Prompt delivery	19.37½	to 19.62½	19.00	to 19.25
Future	19.00	to 19.50	18.75	to 19.25

***OLD METALS**

Heavy copper and wire	14.00	14.00
Brass, heavy	9.00	9.00
Brass, light	8.25	8.25
Lead, heavy	4.20	4.20
Zinc, scrap	4.37½	4.37½

***COPPER EXPORTS**

Total tons to Nov. 24 23,105

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Corning (N. Y.) Gas & Electric Company Reorganization.—The Corning Light & Power Corporation was incorporated recently under the laws of the State of New York, for the purpose of acquiring, extending and improving the properties of the Corning Gas & Electric Company. Capital stock to the amount of $400,000 was authorized, together with an issue of $100,000 in 6 per cent ten-year debenture bonds.

Alabama Hydroelectric Development Progressing Rapidly.—The large hydroelectric development of the Alabama Traction, Light & Power Company, on the Coosa River, near Birmingnam, Ala., is rapidly nearing completion and the company expects to furnish electricity to the Birmingham district from this station early in 1914. A capacity of between 50,000 hp and 60,000 hp will be possessed by this station when completed. At the present time the above-mentioned district is drawing energy from the steam plant operated by this company at Gadsden, Ala., since June of the present year. When the new development is placed in operation this steam plant will be held as reserve capacity.

Federal Utilities, Inc., Passes Preferred Dividend.—The directors of the Federal Utilities, Inc., have decided to pass the regular quarterly dividend of 1½ per cent on its $1,000,000 preferred stock outstanding, due at this time. In explanation of this action, President De Forest Candee has sent the following letter to the stockholders: "The income of your company for the ten months ended Oct. 31, 1913, has been more than sufficient to meet the dividend requirements, but owing to the depreciation in the market value of the securities and the consequent shrinkage in surplus, the directors have deemed it wise to conserve the resources of the company and defer action for the present respecting the payment of the quarterly dividend of 1½ per cent, payable Dec. 1, on your company's 6 per cent cumulative preferred stock."

Nevada-California Power Company Consolidation.—Announcement has been made that funds for the refinancing of the Nevada-California, and for its consolidation with the Southern Sierras Power Company, have been secured. The plans for the new concern include the issue of $5,000,000 capital stock and a bond issue large enough to care for several years' requirements. All the stock of the latter company is held by the former. The Nevada-California Power Company owns three hydroelectric generating plants, with a combined capacity of 18,750 hp, located at Bishop Creek, Cal., and has transmission lines connecting a number of towns in California and Nevada. The Southern Sierras Power Company owns hydroelectric and steam generating stations aggregating 12,750-hp capacity. It also has an extensive transmission system covering a large area in Southern California.

Purchase of Pennsylvania Utility Approved.—Interests associated with the Lehigh Valley Transit Company and the United Gas Improvement Company have submitted a plan for the purchase of the Lehigh & Northampton Light, Heat & Power Company, and this plan has been approved by the bondholders' committee of the latter concern. This company has outstanding $155,000 of first mortgage 5 per cent gold bonds and $214,000 of consolidated mortgage bonds drawing the same interest. The holders of $150,000 of the first-mentioned and of $161,000 of the second-named securities have assented to the purchase plan, as have the stockholders of the company. By this plan there will be paid to the committee $195,000 in cash and $107,000 of the refunding and improvement bonds of the Lehigh Valley Transit Company, which can be converted into cash by the committee. This payment will cover the entire claims of the first mortgage bondholders and a portion of those of the consolidated bondholders.

Washington Utility Plans Increased Capital Stock.—A special meeting of the shareholders of the Washington Water Power Company has been called for Dec. 2, at Spokane, Wash., to authorize the increase of $5,000,000 in the company's capital stock, recently decided upon by its directors. If this proposition is ratified, the capital stock will become $20,000,000. According to a recent statement by D. L. Huntington, president of the company, only part of the new stock will be issued at present, and this will be offered for subscription by the stockholders on a basis of 10 per cent of their holdings. Part of the proceeds of this financing will be used in paying for work now in progress on the Long Lake hydroelectric development. For the year ended Oct. 31 the gross earnings of the company were $3,224,136 and the net earnings, after payment of taxes, amounted to $1,594,496. Up to that time the above mentioned water-power plant had called for a total expenditure of $3,748,852.

Detroit Edison Company's Proposed Financing.—On Dec. 17 there will be held a special meeting of the stockholders of the Detroit Edison Company to pass on the proposal of the company's directors to increase its capital stock $10,000,000 and to issue $6,000,000 of convertible debenture 6 per cent ten-year bonds. Construction work recently completed and extensions and improvements now in progress will, it is claimed, call for the payment of approximately $3,500,000 at this time. It is proposed to issue this portion of the bonds, if authorized, within a short time and to allow the stockholders to subscribe the same at par up to 25 per cent of their holdings. Part of the increase in capital stock, it is understood, will be reserved against the convertible debenture issue and the balance will be held in the treasury for the present, so that no part of it is expected to be issued at this time. The gross earnings of the company for the year ended Oct. 31 amounted to $5,351,524, and the net earnings during the same period were $2,236,582.

Annual Report of Large German Electrical Manufacturer.—The report of the Algemeine Elektricitäts Gesellschaft, Berlin, Germany, for the fiscal year ended June 30, 1913, shows that the company delivered during that period electrical equipment with a total rating of 2,533,985 kw. This output included one 20,000-kw, three 15,500-kw and four 11,500-kw turbo-generators. The total business was $15,000,000 in excess of the preceding year. The net earnings of $7,226,121 enabled the company to pay a dividend of 14 per cent on a capitalization of $38,725,000, to add $250,000 to the employees' welfare fund, to give $300,000 in premiums to officials and to make other payments, including taxes and reserve. The report states that the development of metallic-filament lamps has decreased the output of carbon lamps and arc lamps. The new ½-watt nitrogen lamp is making very gratifying progress and is now manufactured in ratings of 600 cp to 3000 cp. The electric-railway business is also very satisfactory, particularly in orders for high-tension direct-current apparatus and for single-phase heavy railway equipment. Orders are in hand for twenty-seven electric locomotives.

Columbus Utility Merger Proposition Altered.—Plans have been on foot for some time for the reorganization and combination of interests of the Columbus Railway Company, the Columbus Railway & Light Company, the Columbus Edison Company, and the Columbus Light, Heat & Power Company, all operating in and around Columbus, Ohio. A circular letter was recently issued to the stockholders of these companies, giving notice of the status of these negotiations and of an alteration in the original plan made necessary by the presence of an unexpected obstacle. It seems that the first three of the above-mentioned companies have responded to the request for deposit of stocks by placing with the depositary 81 per cent, 88 per cent and 93 per cent, respectively, of their total capital stocks. However, only 43 per cent of the total stock of the last-mentioned company had been deposited, owing to the fact that some of its shareholders were dissatisfied with their part in the consolidation plan. These interests had made an unsuccessful legal fight against the Public Service Commission of the State of Ohio for the purpose of frustrating this plan. The circular letter proposed a way out of the difficulty by going on with the consolidation of the three companies favorable to it, leaving out the other company, whose stockholders opposed it. The consent of the shareholders of the three first companies was asked for this alteration in the original plan of consolidation, and the time limit for depositing or withdrawing stock under the altered plan was changed to Nov. 25. Mr. S. G. McMeen, president of the Columbus Railway & Light Company, is engineering the reorganization.

Business Notes

The Federal Hardware & Electric Company, whose main office is located at 164 Federal Street, Boston, Mass., and whose factory is at Waltham, Mass., is prepared to furnish switchboards, panelboards, cabinets and electrical and combination lighting fixtures, all of which lines it is manufacturing at the present time.

The McIntosh Richards Company, of 349 Division Avenue South, Grand Rapids, Mich., has been engaged for three months in the manufacture of electric lighting fixtures. Mr. W. F. G. McIntosh, president of the company, was formerly associated with the M. B. Wheeler Electric Company and with the Lewis Electric Company.

The H. W. Johns-Manville Company, of New York, has been compelled to seek larger quarters for its Baltimore (Md.) branch. A modern six-story building with a ground area measuring 47 ft. by 187 ft. is now occupied as a store, office and warehouse. This building is located at 207-213 East Saratoga Street, within two blocks of the post office, and right in the heart of the business section.

The Automatic Train Control & Signal Company, of 516 Scarritt Building, Kansas City, Mo., is preparing to enter the electrical field with a line of automatic electrical train controls and signals for use on both steam and electric roads. It is proposed to erect shortly in Kansas City a plant for the manufacture of this apparatus. E. E. Hairgrove is secretary, treasurer and general manager of the company, and Carl Woods is its president.

The Keeler Battery Company has been organized in Louisville, Ky., for the purpose of manufacturing and installing storage batteries. Quarters have been established on Third Street near Green Street. George G. Keeler is president of the company and J. W. Gross secretary and treasurer. The concern reports a growing demand for batteries, an unusual sale recently being that of two 6-volt, 200 amp-hr. batteries for the State Tuberculosis Association of Kentucky. The equipment is used for operating display devices in a demonstration car which has been taken over the State. Batteries were also furnished for lighting banners used in a "flambeau parade" in connection with the recent Perry Centennial in Louisville.

New Industrial Companies

The Edison Turbine Company, of Portland, Maine, has been granted a charter with a capital stock of $1,000,000. Albert F. Jones is president, T. L. Croteau treasurer, and James E. Manter clerk, all of Portland.

The American X-Ray Equipment Company, of New York, N. Y., has been incorporated by John L. Clark, Pompeo M. Maresi and Robert W. Crawford, 52 Broadway, New York, N. Y. The company is capitalized at $35,000.

The Power Transmission Clutch Company, of Rushville, Ind., has been incorporated by O. E. Woodbridge, J. J. Striegel and J. Wiley. The company is capitalized at $30,000 and proposes to manufacture and sell power transmission clutches.

Martins, Adams & Company, of New York, N. Y., has been incorporated with a capital stock of $15,000 to manufacture and deal in electrical machinery, printing, publishing, etc. The incorporators are Everett L. Adams, Percival V. Martin and William P. Heineken, 6 Church Street, New York, N. Y.

The Paige-Detroit Company, of New York, N. Y., has been chartered with a capital stock of $50,000 to manufacture motors, machinery, etc. The incorporators are E. M. Dalley, of Larchmont; S. J. Wise, of New York, and F. W. Kolb, of Brooklyn, N. Y.

The George Allen Mullen Company has filed articles of incorporation under the laws of the State of Delaware for the purpose of doing a general electrical engineering business and electrical work of all kinds. The company is capitalized at $50,000, and the incorporators are F. D. Buck, G. W. Dillman and B. M. Grawl, of Wilmington, Del.

Trade Publications

Switches.—In a recently issued leaflet the Railway & Industrial Engineering Company, Pittsburgh, Pa., briefly describes its simultaneously operated disconnecting switches of all ratings and voltages, for indoor and outdoor mounting.

Telephone Material Price List.—The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., has recently issued some loose-leaf price sheets, superseding all others, referring to its telephone construction material and supplies.

Tube Cleaners.—A thirty-two-page pamphlet recently issued by the Liberty Manufacturing Company, 6903 Susquehanna Street, Pittsburgh, Pa., refers to various types of Liberty tube cleaners for the removal of boiler scale. Illustrations and brief descriptions are given.

Ball Bearings.—In a well-printed booklet of twelve pages the Hess-Bright Manufacturing Company, Philadelphia, Pa., presents a brief discussion concerning ball bearings and their application to axle generators. The railway type of ball bearings is shown, as well as a number of applications of these bearings and their constructive features.

Motor Applications.—"Motor-Driven Dairy, Creamery and Ice-Cream Machinery" is the title of a pamphlet issued by the Westinghouse Electric & Manufacturing Company. The book gives valuable data on its subject matter. A number of interesting views illustrate the method of mounting the motors for driving this class of machinery.

Catalog of Gifts.—A twenty-eight-page catalog bearing the title "Holiday Suggestions" has been issued by the Electric Appliance Company, Chicago, Ill. It is replete with illustrations of electrical household appliances, the most modern of gifts, among which are beautiful portable lamps, practical irons, washing machines and vacuum cleaners, comfortable warming-pads and other devices, as well as Christmas tree outfits.

Pumps.—Bulletin No. 755 of the Platt Iron Works Company, Dayton, Ohio, refers to Platt high-lift and turbine pumps for high heads, water-works, boiler-feeds, mine and similar service. The general construction and principles of operation are illustrated and described. These pumps are built for all heads and service conditions up to 700 ft. The present bulletin shows designs most applicable to ordinary conditions.

Lamps.—The Koerting & Mathiesen Company, 22 East Twenty-first Street, New York, has issued a pamphlet setting forth the reasons why the "Excello" flaming-arc lamp excels. It tells in an interesting manner something of the early history of the arc lamp and devotes a chapter to a discussion of the good points of the "Excello" lamp. The pamphlet is well written, is printed on dull-finished paper and has an attractive cover.

Household Appliances.—The Hotpoint Electric Heating Company, Ontario, Cal., has sent out a broadside addressed to dealers calling their attention to the double-page advertisement in the Saturday *Evening Post* which suggests Hotpoint appliances as ideal Christmas gifts. The poster is printed in red and green ink, and the reverse side shows the design of the "holly" paper in which all Hotpoint appliances for Christmas selling will be sealed.

Christmas Suggestions.—Under the title "Christmas Gift Suggestions," the Central Electric Company, 320-326 South Fifth Avenue, Chicago, has issued an eighty-page catalog with an attractive cover in colors, calling attention to the almost bewildering variety of electrical lamps, cooking and heating utensils, luminous radiators, flashlights, electrical toys and other articles suitable for Christmas presents. Prices are listed for each article, and the catalog is copiously illustrated.

Blue-Printing Machine.—An oblong folder has been issued recently by the Buckeye Engine Company, Salem, Ohio, bearing the unusual title of "Worry Is a Vampire—Kill the Animal." It tells in narrative form the story of the ease with which one manufacturer now makes its blueprints with the Buckeye electric blue-printing machine instead of being dependent on the sun for the operation of printing. A description of the device is given, together with an illustration and some testimonial letters.

Personal Mention

Mr. Henry L. Bennett, who has been acting manager of the municipal electric plant at Chicopee, Mass., has resigned.

Mr. E. J. Wolcott has been elected superintendent and manager of the city light and water-works plants of Harrington, Kan.

Mr. J. H. Sanders has succeeded Mr. J. Stephaney as superintendent of the municipal electric lighting and water plant at Crystal Falls, Mich.

Mr. F. H. Chamberlain, of New York City, has been appointed general manager of the Alabama Power Company, with offices at Birmingham.

Mr. E. S. Fletcher, local manager of the Texas Power & Light Company at Temple, Tex., has also been appointed manager of the plant at Taylor.

Mr. William E. G. Mitchell, president of the Mitchell-Rand Manufacturing Company of New York, was married on Nov. 18 in Brooklyn to Miss Helen Holly Booth.

Mr. Claude H. Cox has resumed his position as manager of the electrical department of the Coeburn (Va.) Light & Power Company, which he resigned last April to travel.

Mr. Dan Break has been appointed general manager of the municipal lighting plant at Ridgetown, Ont., Can., succeeding Mr. W. H. McMachon, who formerly owned the plant.

Mr. H. B. Corning, who was formerly with the Mexico Light & Power Company, has been appointed commercial agent for the Havana (Cuba) Electric Railway, Light & Power Company.

Mr. Victor T. Noonan, of the Rochester (N. Y.) Railway & Light Company, has been appointed safety inspector for the Western New York district by the Empire State Gas & Electric Association.

Mr. M. J. Warner, of Branford, Conn., has been elected secretary and treasurer of the Rockville-Willimantic Lighting Company, which supplies central-station service in Rockville and Willimantic, Conn.

Mr. H. B. Soper, formerly superintendent of the Penn Central Light & Power Company, Altoona, Pa., has become associated with the Connecticut River Transmission Company at Shelburne Falls, Mass.

Mr. Charles Harris, for the last two years electrical engineer of the Salt River project of the Reclamation Service, has been appointed chief inspector of the service's power division, with headquarters at Chicago.

Mr. E. B. Severs has resigned as superintendent of motive power of the Tri-State Railway & Electric Company, of East Liverpool, Ohio, and has accepted a position with the J. G. White Company, of New York.

Mr. George Service, consulting engineer, of Toronto, Ont., has become associated with the Dominion Power & Transmission Company, Ltd., of Hamilton, Ont. He will have charge of the construction of the company's new steam turbine plant.

Mr. R. L. Baldwin has resigned as electrical engineer for Burns & McDonnell, a consulting engineering firm of Kansas City, Mo., to accept an appointment as electrical engineer of the Public Service Commission of the State of Missouri. Mr. Baldwin will make his headquarters at Jefferson City.

Mr. Edward N. Hurley, Chicago, who will sail for Buenos Aires Feb. 7, to visit South American trade centers with members of the Illinois Manufacturers' Association, as noted in our issue of Nov. 22, has also accepted an appointment as United States trade commissioner to South American countries.

Mr. Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, returned this week from a three weeks' trip abroad. Speaking of financial conditions, Mr. Tripp said that business in England is slowing down considerably and that labor conditions in that country are far from satisfactory.

Mr. W. M. Graff, assistant power engineer of the Edison Electric Illuminating Company of Brooklyn and a graduate of Yale, has resigned to accept the position of engineer with the Graves Engineering Company, Inc., of New York. Mr. Graff went to the Brooklyn Edison company from the Hartford (Conn.) Electric Light Company, where he had been engaged in power-cost investigations. He was at one time an instructor in power-plant testing at Yale.

Mr. Georges Claude, whose argon-filled tube lamp has recently been demonstrated in this country, began his career as an investigator in 1886, at which time he worked under d'Arsonval in the École de Physique et Chimie de Paris, where he continued until 1889. From 1890 to 1894 he was chief of the laboratory of the municipal electric station. In this early period his work was confined to electricity and resulted in the invention of an instrument for measuring phase difference between two currents, a method of measuring efficiency of transformers and a method of localizing faults in street railway tracks by means of high-frequency currents. According to d'Arsonval this is one of the first practical applications of high-frequency currents. Between 1896 and 1902 Claude was engineer in charge of scientific research work for the French Thomson-Houston Company, during which time he made an exhaustive series of experiments on return currents in street railway systems. Another service rendered by him to the science of electricity was the writing of a popular book on electricity of which over 36,000 copies were sold and for which he was awarded, in 1904, the Hébert prize by the Académie de Sciences. However, the most important works of Claude were in connection with practical applications of gases. In the year 1895, in conjunction with Mr. A. Hess, he developed a method of dissolving acetylene which has done much to promote the practical development of oxy-acetylene welding. Following the work of Linde in the liquefaction of air, he invented the methods of liquefaction under pressure and also the compound-stage liquefaction. The liquid air he utilized for separating oxygen and nitrogen. For this work Claude was awarded the Montyou prize in 1908 by the Académie de Sciences. The theory of the processes by which he separated oxygen and nitrogen was set forth in his book "Liquid Air, Oxygen and Nitrogen," published in Paris in 1909. Following along the same general lines many special processes have been developed, for instance, the preparation of very pure nitrogen, the manufacture of hydrogen and carbon dioxide. In the field of pure science Claude has developed apparatus for extracting neon and helium in large quantities and under conditions which permitted him to measure with accuracy the content of these gases in the atmosphere. His work along this line has been of much benefit to a large number of scientists, and he himself made practical use of neon in the production of the neon-tube lamp, one of his latest inventions. In addition to the prizes mentioned above, Claude has received the Michel Alcon prize of the Société des Ingénieurs Civils. He is a member of the Council of the Société Française de Physique, a member of the Council of the Association du Froid, a member of the Commission on Explosive Substances, and a member of the Council of the Société des Ingénieurs Civils. In 1908 he was vice-president of the first section of the International Refrigeration Congress in Paris, and in 1911 he was president of the first section of the International Refrigeration Congress in Vienna.

Obituary

W. E. Dunbar, assistant electrical engineer in charge of substations on overhead lines of the Aurora, Elgin & Chicago Railroad, Wheaton, Ill., died at his home in Elgin, Ill., on Nov. 15. Mr. Dunbar and his assistant were making an inspection trip on a gasoline speeder on Nov. 6 when the car jumped the track at Ingalton, Ill., fatally injuring Mr. Dunbar and instantly killing his assistant.

John Donovan, formerly president of the St. Joseph (Mo.) Railway, Light, Heat & Power Company, is dead. Mr. Donovan was fifty-nine years old and was interested in a number of enterprises other than the railway and lighting company. He was credited with bringing the packing houses to St. Joseph and was president of the St. Joseph Stock Yards Company. A widow and a daughter survive him.

Construction

New England

NEW MARKET, N. H.—The New Market El. Co. expects to erect a new power house and to purchase new waterwheels within the next 12 months. Fred B. Philbrick is general manager.

AMHERST, MASS.—A new contract for street-lighting has been signed with the Amherst Gas Co. for lighting the town with electricity for a period of three years from June 1, 1913. Under the terms of the new contract the present 32-cp lamps are to be replaced with 48-cp lamps, and the arc lamps now in use are to be replaced partly wtih high-candle-power incandescent lamps and partly by an equivalent number of smaller incandescent lamps.

BRIDGEPORT, CONN.—Bids will be received in the office of the Board of Education, Bridgeport, Conn., for the following branches of work in connection with the Bridgeport High School, to be erected at Congress Street and Lyon Terrace: general work, heating and ventilating, plumbing and electrical work. Plans and specifictions may be obtained at the office of the board, Bridgeport, or at the office of James Gamble Rogers, architect, 470 Fourth Avenue, New York, N. Y., where copies of plans and specifications may be obtained, for which a deposit of $50 will be required for general work, and $25 each for heating and ventilating, plumbing and electrical work, to be refunded upon return of same. William B. Boardman is secretary of Board of Education.

Middle Atlantic

ADDISON, N. Y.—The Addison El. Lt. & Pwr. Co. expects to purchase within the the next 12 months one 125-hp gas engine for natural and producer gas. L. P. Zimmer is manager and secretary.

CASTLETON, N. Y.—The Schodack Lt. & Pwr. Co., of Castleton, expects within the next six months to purchase 25 poles, two transformers, 25 meters, 2000 ft. No. 2 wire, 2000 ft. No. 8 wire, 200 ft. No. 4 wire, 50 incandescent lamps and 100 tungsten lamps (from 25 watt to 60 watt). The company purchases electricity from the A. C. Cheney Piano Action Co. L. M. Lansing is treasurer and manager.

CHATEAUGAY, N. Y.—The Chasm Pwr. Co., of Chateaugay, expects to erect 5 miles of 13,200-volt transmission line, crossing the Canadian border within the next six months. W. T. Thayer is manager.

DUNKIRK, N. Y.—The Dunkirk Merchants' Exchange has appointed a committee to promote the installation of ornamental cluster lamps on the principal business streets to replace the arches now in use.

JAMESTOWN, N. Y.—Within the next four months the Jamestown Ltg. & Pwr. Co. expects to purchase one carload of poles; also within the next few months a few ornamental lamp-posts. Albert S. Price is secretary and treasurer.

LITTLE VALLEY, N. Y.—Within the next few months the managers of the municipal electric-light plant expect to purchase one 150 hp four-cylinder gas engine, one 15-hp to 20-hp, single-phase motor and one two-stage centrifugal pump for the municipal electric-light plant. Two Westinghouse constant-current regulators have recently been installed and the street-lighting system changed from arc lamps to cluster and single lamp standards, consisting of about 160 single 100-watt lamps, four three-lamp clusters (100-watt lamps), and six two-lamp clusters (100-watt lamps). G. S. Boller is superintendent of municipal electric-light plant.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until Dec. 1, for installing electric elevators in the Bay Ridge High School, on Fourth Avenue, between Sixty-seventh Street and Senator Street. Blank forms and specifications may be obtained or seen at the office of the superintendent; also at the branch office, 131 Livingston Street, Brooklyn.

ONEONTA, N. Y.—The Oneonta Lt. & Power Co. expects within the next six months to install one 250-hp steam engine and a 250-hp boiler. G. A. Lane is general manager.

AKRON, PA.—The Akron El. Lt. & Pwr. Co. expects to purchase within the next eight months one 75-hp producer-gas engine, one 50-kva, 60-cycle, three-phase generator (257 r.p.m.), with exciter for same. A. N. Wolf is treasurer.

JOHNSTOWN, PA.—Arrangements are being made by the Dale Lt., Ht. & Pwr. Co., of Johnstown, for further extensions of its service in the city proper. Orders have been placed for 500 poles, which will be erected in the Seventh Ward.

JUNIATA, PA.—The Borough Council has granted the Raystown Wtr. Co., of Huntingdon, a franchise to furnish electricity in Juniata. Electricity will be transmitted from the plant near Huntingdon, a distance of about 40 miles.

MEADVILLE, PA.—The People's Incandescent Lt. Co., of Meadville, Pa., has just completed the erection of a substation at Richley's Grove and has placed contract for substation, passenger station and freight station building at Edinboro, Pa. Electric equipment (consisting of a 500-kw rotary converter for each station) has been purchased from the Westinghouse El. & Mfg. Co. The company is erecting a 33,000-volt transmission line from Erie to Venango, and is also installing electric-lighting equipment at Edinboro substation and it expects to install lighting equipment at the Venango substation in the spring. Material for the above work has been purchased from the Westinghouse El. & Mfg. Co. Charles M. Hatch is general manager.

SHARON, PA.—The Shenango Valley El. Lt. Co., of Sharon, has submitted a proposal to the City Council offering to replace the present gas lamps with 100-watt and 150-watt tungsten lamps. There are now 58 gas lamps in use. J. C. Chesnut is superintendent of the company.

JERSEY CITY, N. J.—A report is being prepared by Frank Hague, commissioner of public safety, showing the necessity for the installation of a new fire-alarm system. The cost is estimated at about $10,000.

NEWARK, N. J.—The Public Service El. Co., of New Jersey, is planning to erect a substation at Burlington and Oliver Streets, Bordentown, and another on Monroe Street, Riverside, to cost about $50,000 each.

PERTH AMBOY, N. J.—The installation of a new street-lighting system on State Street, from Smith Street northerly, is being considered by the City Council and property owners on State Street. It is proposed to use ornamental iron upright posts with brackets to support lamps.

SALEM, N. J.—The power house and boiler plant of the Salem Glass Works were partially destroyed by fire with other buildings on Nov. 17. It is understood that the buildings will be rebuilt immediately. Isaac Bacon is superintendent.

WILMINGTON, DEL.—Within the next six months the Wilmington & Philadelphia Trac. Co. expects to erect 4 miles of 6600-volt, three-phase transmission line. J. A. Berndt is purchasing agent.

BALTIMORE, MD.—Plans are now being prepared by Robert J. McCuen, superintendent of lamps and lighting, for extending the ornamental lighting system in the residential sections. During the coming year the ornamental lamps will be installed on the second section of the Fallsway from Bath to Madison Street; also on the first section of the Key Highway, from Light to Montgomery Street, and on several other streets.

CLARKSBURG, W. VA.—Within the next few months the Clarksburg Gas & El. Co. expects to build a new power station and to purchase a 2000-kw turbine, generators, boilers and other equipment, including exciters, switches, protective devices, pumps, condensers, etc. Leonard Peck is superintendent.

WINCHESTER, VA.—The Northern Virginia Pwr. Co., of Winchester, is completing a 25-mile transmission line (three-phase, 60 cycles, 22,000 volts) connecting its lines at Martinsburg with the lines at Berkeley Springs. The company has recently purchased a 1000-hp waterwheel and generator, vertical type, for its hydraulic plant at Millville. D. M. Swink is superintendent.

WASHINGTON, D. C.—Bids will be received at office of chief signal officer, War Department, Washington, D. C., until Dec. 3, under Proposal 683, for furnishing the following supplies: (1) For eight electrical engineers' tool chests, complete, as per specification 192-D; (2) nine standard oil equipments, complete for switchboard rooms, as per specification 407. Major W. L. Clarke is disbursing officer.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 9 for furnishing at the various navy yards and naval stations the following supplies: Brooklyn, N. Y., Schedule 6055—2000 t. desk telephone cord; 20,000 ft. twisted telephone wire; 4000 ft. steel conduit (¾-in. iron-pipe size). Brooklyn, N. Y., and Norfolk, Va., Schedule 6055—39 portable safety electric lanterns. Newport, R. I., Schedule 6030—installing electric lighting system. Bids will also be received at the same place until Dec. 16 as follows: Puget Sound, Wash., Schedule 6041—two electrically driven ventilating fans; Schedule 6035—two sets engines and pumps. Mare Island, Cal., Schedule 6037—6000 lb. calcium carbide; Schedule 6038—5000 lb. chloride of calcium.

North Central

ADRIAN, MICH.—The Citizens' Lt. & Pwr. Co., of Adrian, is considering the installation of a 30-ton ice factory in connection with its electric plant. H. A. Fee is manager.

FORD, MICH.—The village officials contemplate calling a special election in the near future to vote on a proposed bond issue of $20,000, the proceeds to be used for extensions to the lighting system and other municipal improvements. Ford has not a post office.

GAYLORD, MICH.—The power house of the Saginaw Products Co. will be 100 ft. long by 40 ft. wide. The station will be equipped with two Corliss engines, a generator and a special engine to operate generator.

HOLLAND, MICH.—The Board of Public Works expects to purchase within the next 12 months material for distribution system, including 50 to 100 kva in transformers, one carload of poles, 12 arresters, two barrels of insulators, 6000 ft. of wire and 200 meters (estimates are given approximately), and 25 arc lamps. R. B. Champion is superintendent of public works.

MARQUETTE, MICH.—The Marquette County Gas & El. Co. is contemplating extending its service to the Palmer District.

ONAWAY, MICH.—The Onaway El. Lt. & Pwr. Co. expects to duplicate its power-house equipment within the next six months and to pur-

chase one 150-kw or 200-kw generator and waterwheel and waterwheel governor. Herbert H. Vaughn is secretary and treasurer.

THREE OAKS, MICH.—Within the next few months the managers of the municipal electric-light plant expect to purchase two engines, a generator, two exciters and switchboard; also transformers for line, changing the system from 133 to 60 cycles. R. E. Schmuhl is engineer.

CLEVELAND, OHIO.—Bids will be received at the office of W. H. Kirby, secretary to the director of public service, 204 City Hall, Cleveland, until Dec. 10 for distribution switchboard and equipment for the municipal electric-light plant. Bids will also be received for steam-turbine-driven exciter set for the municipal electric-light plant. Plans and specifications may be obtained at the office of the engineer of construction, Room 419, City Hall, Cleveland. W. J. Springborn is director of public service.

DEFIANCE, OHIO.—The Auglaize Pwr. Co., of Defiance, expects to erect within the next two months 7½ miles of 33,000-volt transmission line from Neapolis to Swanton, to furnish electricity to the Swanton Lt. & Pwr. Co. W. P. Wallace is general manager.

GALLIPOLIS, OHIO.—Experiments are being made with a view of installing a new street-lighting system. Dr. Bean is chairman of the street-lighting committee.

GRANVILLE, OHIO.—Within the next six months the managers of the municipal electric-light plant expect to build a new power house and to purchase one 100-hp horizontal tubular boiler. Joseph S. Rodes is superintendent.

LA RUE, OHIO.—The Village Council has granted the Joseph Slanser Lumber Co. a franchise to furnish electricity for street and commercial lighting in La Rue for a period of 10 years, the present contract expiring Dec. 31. The company will make improvements to its plant, including the installation of a new street-lighting system.

UPPER SANDUSKY, OHIO.—At an election held recently the proposal to issue $25,000 in bonds for the construction of a municipal electric-light plant was carried.

WILMINGTON, OHIO.—The property of the Wilmington Wtr. & Lt. Co. has been purchased by the Dayton Pwr. & Lt. Co., of Dayton. Electricity for operating the local system will be supplied from the Dayton plant.

YOUNGSTOWN, OHIO.—The Mahoning County Lt. Co., recently incorporated, has applied to the State Utilities Commission for authority to issue securities to finance the construction of a plant.

BEAVER DAM, KY.—Plans are being considered for the installation of a municipal electric-light plant, for which bonds have been voted.

LEXINGTON, KY.—The Lexington Utilities Co. expects to purchase within the next few months its usual supply of electrical appliances and supplies, including heating and cooling apparatus, household labor devices, including vacuum cleaners, washing machines, wiring supplies, switches, etc. J. P. Pope is electrical engineer.

LOUISVILLE, KY.—The Louisville Clothing Co. has decided to increase the output of its plant and expects to purchase some electric motors. M. R. Harned is president.

LOUISVILLE, KY.—The installation of an electric-light plant at the city workhouse is reported to be under consideration by the Board of Public Safety. Rush C. Watkins is chairman.

MAYSVILLE, KY.—The city of Maysville is contemplating the installation of a street-lighting system and is now advertising for bids on installation and operating same. An ornamental lighting system is to be installed in the down-town district. The cost of maintaining the system is estimated at $10,000 per year.

SCOTTSVILLE, KY.—The local electric-light plant, owned by G. D. Read, has been leased to Mays & Schlinker, of Glasgow, Ky. It is understood that improvements will be made to the plant, including the installation of an engine and generator.

NORTH JUDSON, IND.—The North Judson El. Co. within the next six months expects to erect about 12 miles of transmission line; it also expects to purchase within the next 30 days 32 or 34 boulevard lamp-posts for five-lamp clusters. F. D. Pixa is secretary and treasurer.

ALEDO, ILL.—The Town Council has adopted a resolution authorizing a committee to engage consulting engineers to make investigations regarding the cost of the installation of a municipal electric-light plant; it is also proposed to install a heating plant.

BELVIDERE, ILL.—The Illinois Northern Utilities Co. is reported to have purchased a site in Belvidere, upon which it proposes to erect a large power plant, to cost about $500,000.

BUSHNELL, ILL.—The contract for installing ornamental street lamps has been awarded to the McComb El. Construction Co., of Macomb.

CHICAGO, ILL.—The capital stock of the Universal Utilities Co. of Illinois has been increased from $50,000 to $500,000.

DANVILLE, ILL.—The Danville St. Ry. & Lt. Co., it is reported, is contemplating extensive improvements to its system, involving an expenditure of about $250,000. The work will include the installation of steam turbine and condensing apparatus, to cost about $180,000; also new street cars, at a cost of about $34,000.

DIXON, ILL.—The Illinois Northern Utilities Co., 137 South La Salle Street, Chicago, has recently closed 10-year contracts for street lighting in the following towns and cities: Belvidere, Harvard, Capron, Kingston, Kirkland, Earlville, Adeline and Mount Morris. It has recently completed the installation of street-lighting systems in Fulton, Amboy, West Brooklyn, Franklin Grove, Forreston, Somonauk, Leland, Sandwich and Dixon and has recently completed the installation of ornamental street-lighting systems in Amboy, Franklin Grove, Forreston, Dixon and Harvard. The company now has under way the installation of ornamental street-lighting systems in Belvidere, Sterling, Fulton, Oregon, Genoa, Plano and Earlville. Charles Bryant is general contract agent.

FREEPORT, ILL.—Plans are being prepared by the Freeport Ry. & Lt. Co. for the installation of a new lighting system to be installed at the expiration of the present street-lighting contract two years hence. Mr. Pengra is acting manager of the company.

HILLSBORO, ILL.—The Southern Illinois Lt. & Pwr. Co., of Hillsboro, will extend its transmission lines to Greenville. The equipment will include two-panel substation switchboard with voltmeter, wattmeter and oil switches, one 50-kva, 16,500-volt transformer, 320 30-ft. white cedar poles, 24 miles No. 6 hard-drawn copper wire, 100 Westinghouse meters and 30 tungsten lamps of 60 cp. B. H. Walcher is secretary.

JOLIET, ILL.—The installation of electrical equipment to operate the city water-works pumping station is said to be favored by Mayor Harvey Wood. The cost of equipping the same is estimated at $35,000.

KEWANEE, ILL.—Steps have been taken by the City Council to secure an engineer to make an estimate of the cost of installing a municipal electric plant to furnish electricity for lighting the streets and for commercial and power purposes. E. L. Brown, president of the Galva El. Lt. Co., of Galva, it is reported, is contemplating applying for a franchise to install an electrical distributing system in the city. Electricity would be supplied from the plant at Galva.

LA SALLE, ILL.—The City Council has passed an ordinance requiring all wires in the business district to be placed underground.

LA SALLE, ILL.—The Marquette Cement Co., of La Salle, contemplates the installation of a 3000-kw generator and engine in its power plant.

MATTOON, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, has filed a certificate with the Secretary of State showing an increase in capital stock from $6,000,000 to $10,000,000. The company is said to be working out a scheme for merging the public utilities in Central Illinois.

MORRISON, ILL.—The light committee of the City Council in its report advises the construction of a municipal electric-light plant.

MOUNT VERNON, ILL.—The Citizens' Gas, El. & Htg. Co., of Mount Vernon, is seeking an extension of its franchise in this city with a view of extending the lighting territory. H. E Brandli is manager.

NAPERVILLE, ILL.—Improvements are now being made to the municipal electric-light and water plant, involving an expenditure of about $30,000. Oliver W. Strubler is city controller.

PEORIA, ILL.—The residents of Hamilton Boulevard from Monroe Street to North Street have notified the City Council that they will install ornamental lamps if the city will maintain them. John E. King is interested.

SULLIVAN, ILL.—The City Council has granted permission to a number of property owners to install ornamental lamps in front of their property and has announced that the city will supply electricity for all ornamental lamps erected on the streets by individuals.

MADISON, WIS.—We are informed that the city of Madison does not contemplate the installation of an ornamental street-lighting system, as reported in the issue of Oct. 25. The merchants on one street have been trying to make arrangements to install ornamental street lamps on that thoroughfare. O. S. Norsman is city clerk.

RICHLAND CENTER, WIS.—The Managers of the municipal electric-light plant expect to erect within the next ten months an engine room to provide space for a new 312-kva, three-phase, 2300-volt generating unit (directly connected), which will be purchased within the next 12 months. R. H. Strang is superintendent.

BEMIDJI, MINN.—The Beltraimi El. Lt. & Pwr. Co., of Bemidji, expects to purchase within the next four months two car loads of cedar poles.

HUTCHINSON, MINN.—Within the next two weeks the Hutchinson Ltg. & Mfg. Co. will complete a 13,200-volt transmission line to Glencoe (17½ miles long), together with substation apparatus and synchronous condenser at Glencoe, including three generator switchboard panels and one distribution panel. The company also expects to purchase within the next six months a 250-kva generating unit, probably turbine. Thomas Pitts is manager.

WINONA, MINN.—An organization has been formed for the purpose of making arrangements for the installation and maintenance of an ornamental street-lighting system in Winona. B. A. Gernes is secretary.

DES MOINES, IA.—The City Council is considering the question of establishing a municipal electric-light plant at the market house for the purpose of supplying electricity for lighting the city buildings, most of which are located near the civic center.

INDEPENDENCE, IA.—Bids will be received by the city of Independence until Dec. 8 for two horizontal tubular boilers of 150 hp each. Specifications may be seen at the office of the city clerk. George D. Warren is superintendent of the municipal water and light plants.

ROCK RAPIDS, IA.—Steps have been taken by the Commercial Club for the installation of electroliers on the two principal streets; also to remove the electric-light and telephone poles from the principal streets

to the alleys. The new lighting system, it is expected, will be installed in the spring.

PALMYRA, MO.—The Water and Light Commission expects to purchase by Jan. 1, 1914, 200 watt-hour meters. Charles S. Petti is secretary of the Water and Light Commission.

PIEDMONT, MO.—Application has been made to the City Council by W. E. Bunyard, of Bonne Terre, for a 20-year franchise to construct and operate an electric-light plant in Piedmont.

ST. LOUIS, MO.—The Electric Co. of Missouri, of St. Louis, expects to erect within the next eight months three substations and about 50 miles of 13,000-volt transmission line; also to purchase material for distribution system, including transformers, poles, transmission towers, lightning arresters, underground conduit, distribution cable, wire, meters, etc. (about $50,000), and to purchase 200 incandescent lamps, lamp fixtures, transformers, etc.; also to expend within the next 12 months about $5,000 for electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. J. E. Hillmeyer is engineer.

WHITE, S. D.—The White El. Lt. & Pwr. Co. is planning to install an electric-light plant here. The equipment will consist of one 20-hp and one 30-hp Muncie crude oil engine belted to a 20-kw generator and one 12-kw generator belted to the 12-hp crude oil engine. Electrical equipment has not yet been ordered. Hugh Triplett, of White, is engineer in charge, George M. Blasdell is owner and manager, and Fred Miner is superintendent.

YANKTON, S. D.—The Yankton Lt., Ht. & Pwr. Co. has completed the construction of a new power station and has installed a new 75-kw generator directly connected to an American Ball engine, and a new six-panel switchboard. The primary voltage was changed from 1100 to 2300 on Oct. 12. Robert Ferris is secretary and treasurer.

MEAD, NEB.—The installation of a municipal electric-light plant in Mead is under consideration, and bonds have been issued for it.

OMAHA, NEB.—The Omaha & Lincoln Ry. & Lt. Co., of Omaha, within the next three months expects to purchase material for distribution system, including transformers, transmission towers, distribution cable, wire, meters, for about 20 miles of transmission line; also to purchase material for lighting system, including tub transformers, rectifiers, arc lamps, incandescent lamps, posts, etc. Arthur English is agent.

GREENSBURG, KAN.—Bonds to the amount of $30,000 have been voted for the installation of an electric-light plant and water-works system.

PROTECTION, KAN.—The city of Protection will take over the local electric-light plant. We are informed that no improvements are contemplated. H. H. Griffith is city clerk.

STOCKTON, KAN.—Within the next two months the town of Stockton expects to purchase one pump and motor (directly connected), having a capacity of 300 gal. per minute, under a 243-ft. head. Pump to be single-acting capacity. O. M. Goodrich is superintendent.

Southern States

MOORESVILLE, N. C.—The managers of the municipal electric-light plant expect in the near future to install a regulator for lighting and to erect a three-phase transmission line to supply electricity for motors only. James L. Donald is superintendent.

MOUNT GILEAD, N. C.—The town of Mount Gilead has made arrangements whereby S. J. Smitherman and J. C. Hurley, of Troy, will furnish electricity for lighting the town from their plant on Little River, about 7 miles from Mount Gilead.

OLD FORT, N. C.—The White Coal Pwr. Co., it is reported, contemplates the construction of a hydroelectric plant on the Catawba River; also a water-works system. Daniel W. Adams, 301 Legal Building, Asheville, is chief engineer.

SCOTLAND NECK, N. C.—The Electric Light Commission expects to erect within the next two months an addition to power house (30 ft. by 60 ft.); also to purchase a 200-hp boiler, one 150-kw to 200-kw, three-phase, 60-cycle generator, with auxiliaries, and one 250-hp engine directly connected to above generator. L. R. Mills, Jr., is superintendent.

AMERICUS, GA.—The Americus Gas & El. Co. expects to rebuild and consolidate its transmission lines and those of the American Power Co. W. M. Case is general manager.

ATLANTA, GA.—Bids will be received by the Commissioners of Fulton County, Fulton County Court House, Atlanta, Ga., until Dec. 20, for furnishing steel filing devices and equipment, wood furniture and lighting fixtures with lamps for installation. Plans and specifications and other information may be obtained at the office of A. Ten Eyck Brown and Morgan & Dillon, Forsyth Building, Atlanta, Ga., upon a deposit of $20 for each item. H. M. Wood is clerk.

GRIFFIN, GA.—Within the next two or three months the Towaliga Falls Pwr. Co. expects to purchase one 1400-kw generator, one 1800-hp waterwheel, a waterwheel governor and a generator switchboard panel. Frank Mayes is superintendent.

VALDOSTA, GA.—The Valdosta Ltg. Co. expects to erect within the next two months several miles of transmission lines. W. G. Eager is vice-president.

JACKSONVILLE, FLA.—Bids will be received by the Board of Trustees for the Waterworks and Improvement Bonds, city of Jacksonville, until Dec. 4 for furnishing and erecting complete the necessary piping, pipe covering and attachments for one battery of boilers in the new power station. Plans and specifications are on file in the office of the board in Jacksonville and in the office of the Scofield Engineering Co., consulting engineer, Philadelphia, Pa. Frank Richardson is chairman of board.

KISSIMMEE, FLA.—We are informed that nothing definite has yet been decided in regard to increasing the output of the municipal electric-light plant. The city may enlarge the plant, probably next summer. J. R. Gilbert is city clerk.

OVIEDO, FLA.—The installation of an electric-light plant and ice factory in Oviedo is under consideration. F. Kaiser, of Sanford, is reported interested in the project.

GRENADA, MISS.—The manager of the municipal electric-light plant expects to purchase within the next 12 months 20 lamp standards, carrying five-lamp clusters for street-lighting. J. W. Lowry is superintendent.

HOT SPRINGS, ARK.—Plans of W. M. Kavanaugh, president of the Little Rock Ry. & Lt. Co., of Little Rock, for the immediate development of the water-power of the Ouachita River near Hot Springs by the Garland Pwr. & Development Co., it is reported, have been approved by the officials of the American Cities Co., of New York, N. Y., which controls the Little Rock Ry. & Lt. Co. and Garland Pwr. Co. The proposed plant will furnish electricity to operate the street-railway lines in Little Rock, together with the proposed interurban lines, local factories, and also for lamps and motors in Memphis, Tenn.

PRAIRIE GROVE, ARK.—An improvement district has been formed and a petition is being circulated for the purpose of issuing $50,000 in bonds for the construction of a municipal electric-light plant and water-works system. Albert C. Moore, of Joplin, Mo., is engineer.

AFTON, OKLA.—Within the next six months the managers of the municipal electric-light plant expect to purchase a motor-driven air compressor (with a capacity of pumping 500 gal. per minute); also to purchase within the next seven months lightning arresters for 2300-volt circuit, meters and other line material, and also within the next eight months some electrical appliances. W. E. Blackwell is superintendent.

ELK CITY, OKLA.—The city of Elk City is planning to install a water-works system, by driving four deep weels, to cost about $10,000. The equipment will include three pumps (capacity of 60 gal. per minute), dynamo, three motors, carload of vitrified pipe and 2500 ft. of 2-in. pipe to carry water from wells to filter basin. Carl L. Reid, of Elk City, is engineer.

LUBBOCK, TEX.—The City Council has decided to install ornamental street lamps from the Santa Fé depot to the Court House Square and up Broadway. The plans call for 36 single 100-cp lamps and nine cluster lamps.

Pacific States

BREMERTON, WASH.—W. D. Peters, of Bremerton, representing promoters, has submitted a proposal to the City Council offering to build a light and power plant, to cost $288,000, which will be turned over to the city at the end of two years. Electricity will be brought from an outside source. Names of the promoters are not given.

KIRKLAND, WASH.—Patrick Judge, owner of a power site on the Tolt River, has recently transferred his holdings to a New York syndicate, which has organized a power and development company, which contemplates building a hydroelectric plant on the property. Plans for the proposed plant have been prepared by M. McLean, of Kirkland.

LEBAM, WASH.—A franchise has been granted to R. L. Fisher, of Raymond, for the construction of an electric-light and power plant for a period of 50 years. It is understood that work will begin on construction of the plant at once.

NORTH YAKIMA, WASH.—Plans have been submitted to the City Commissioners by George Sawyer, manager of the Pacific Pwr. & Lt. Co., of North Yakima, for the installation of a cluster-lamp lighting system on Yakima Avenue from Natchez Avenue to Sixth Avenue.

SEATTLE, WASH.—J. D. Ross, superintendent of lighting, representing the city of Seattle, has applied to the Commissioners of Kings County for an exclusive franchise to erect transmission lines over the highways of Kings County for the distribution of electricity.

SEATTLE, WASH.—The utilities committee of the City Council recently introduced an ordinance appropriating $20,000 from the light depreciation fund to be used for installing heavier electrical apparatus at the substation of the municipal electric-light plant at Seventh Avenue and Yesler Way, to meet the increasing demand for service in that district.

SEATTLE, WASH.—Contracts will be awarded by the Light Department of the city of Seattle about Dec. 1 for equipment for auxiliary steam-power plant, to be located at the foot of Nelson Place on Lake Union. The equipment will consist of boilers, two, four or six units, having a total rating of 2400 hp; one 5000-kw steam turbine and one 5000-kw generator. J. D. Ross is superintendent of lighting.

SPOKANE, WASH.—A special meeting of the stockholders of the Washington Wtr. Pwr. Co., of Spokane, has been called for Dec. 2

to vote on the proposal to increase the capital stock of the company by $5,000,000. The proceeds are to be used for construction work at Long Lake and other extensions.

HEPPNER, ORE.—The Heppner Lt. & Wtr. Co. is building an addition to its power plant and has recently purchased two 125-hp Babcock & Wilcox boilers, one 14-in. by 36-in. Corliss engine and one 100-kw and one 150-kw generator; also all auxiliary and switching equipment with the exception of condenser and feed-water heater. The company expects to purchase within the next six months electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. H. V. Gates is president.

PAISLEY, ORE.—Application has been made by C. R. Potts for a franchise to construct and operate an electric-light plant on the Chewatean River above Paisley and to furnish electricity in this city.

ALAMEDA, CAL.—Plans are being prepared by A. L. Mazurette, architect, Bacon Building, Oakland, for the erection of a group of buildings by the Alameda Baths, Swimming & Casino Co., to cost about $200,000. The plans provide for a large power house, steam-heating system and pumping plant, casino and bath houses.

CLOVERDALE, CAL.—The California Tel. & Lt. Co., of Cloverdale, has applied to the State Railroad Commission for permission to issue $100,000 in bonds and $50,000 in capital stock, the proceeds to be used for extensions to its service. The company proposes to extend its lines in the Ukiah, Coyote and Potter Valley sections to supply electricity for irrigation plants and for lamps and motors; also to furnish a telephone service.

HOLTVILLE, CAL.—The Holton Pwr. Co., it is reported, has made arrangements with one of the large coast companies to erect a high-tension transmission line to the Coachella Valley to connect with its lines. The cost of the new line is estimated at $250,000; other improvements are contemplated by the Holton Pwr. Co., which will cost as much more.

LOS ANGELES, CAL.—The South Park Improvement Association has asked the City Council for $2,500 for the installation of a permanent electrolier lighting system in South Park.

SAN FRANCISCO, CAL.—The directors of the Ocean Shore R.R. Co., of San Francisco, have taken formal action toward changing the motive power of the railroad from steam to electricity. The cost of the work is estimated at $150,000.

BRIGHAM CITY, UTAH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 2, 1914, for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Brigham City. Drawings and specifications may be obtained from the custodian of site, at Brigham City, or from the above office. O. Wenderoth is supervising architect.

SALT LAKE CITY, UTAH.—Application has been made to the City Commission by Robert S. Campbell for a franchise to construct and operate a central heating, lighting and power plant to furnish heat and electricity to a large section of the city. Mr. Campbell also asks permission to lay underground conduits, pipes and erect poles to distribute electricity for lamps, heat and motors to all the territory between Second East and Third West and Fifth South and Second North Streets.

BUTTE, MONT.—The City Council has authorized Mayor Duncan to sign a contract with the Montana Pwr. Co., of Butte, for the installation of a new ornamental street-lighting system. The contract is for a period of seven years and calls for the installation of 306 lamps.

ALAMOGORDO, N. M.—Within the next three months the Alamogordo Lt. & Pwr. Co. expects to purchase a 120-hp oil engine and an 80-kw., 60-cycle, 2300-volt generator complete; also within the next six months to purchase 50 meters.

Canada

NEEPAWA, MAN.—The town of Neepawa is contemplating the purchase of two 150-hp boilers, one 150-kw, three-phase generator and switchboard within the next six months; also the erection of a smoke-stack 48 in. by 84 ft. The proposed improvements depend upon the vote of the taxpayers. J. W. Bradley is secretary and treasurer.

FORT WILLIAM, ONT.—The Kaministiquia Pwr. Co., of Fort William, expects to install within the next ten months an additional 12,000-hp turbo-generator set, with necessary switching apparatus; 19 miles of No. 00 transmission line and 25,000-volt transformer banks at each end of the line. Equipment for above has already been purchased. P. R. Barrow is superintendent.

HAMILTON, ONT.—The Dominion Pwr. & Transmission Co. is contemplating the erection of a steam-power plant in Hamilton, the initial installation to consist of two units of 10,000 hp each, with provision for the installation of two additional units with the same rating. While tentative plans have been prepared, it has not yet been decided when the work will be undertaken.

SUDBURY, ONT.—Within the next six months the managers of the municipal electric-light plant expect to purchase 100 wattmeters. R. H. Martindale is superintendent.

MONTCALMVILLE, QUE.—The City Council is considering the installation of an ornamental street-lighting system.

OUTLOOK, SASK.—The by-law authorizing an expenditure of $10,500 for extensions to the electric-lighting system has been passed.

New Incorporations

WILMINGTON, DEL.—The Castle Lt. Co. has filed articles of incorporation with a capital stock of $50,000. The incorporators are: G. L. Townsend, Jr., of Middletown; C. F. Curley and A. M. Haley, of Wilmington.

FORT MEADE, FLA.—The Southern Ice & Pwr. Co. has been incorporated with a capital stock of $50,000 to construct an ice and electric-light plant.

AMERICUS, GA.—The Public Utilities Co. has been incorporated with a capital stock of $300,000 by Louis F. Doyle, William C. Potter and Thomas J. Brown, all of New York, N. Y. The company proposes to operate electric-light, power plant and gas works.

MOUNT CARMEL, ILL.—The Mount Carmel Public Utility & Service Co. has been incorporated by J. E. Robinson, J. M. Mitchell and G. A. Well. The company is capitalized at $300,000 and proposes to operate water, light, heat and power plants.

PORTLAND, MAINE.—Articles of incorporation have been filed for the Northwest Company with a capital stock of $200,000 to buy and develop water-power, mines, steam, gas and electric roads, steamships, etc. The directors are: Albert T. Jones, president; T. L. Croteau, treasurer; Albert A. Richards, B. M. Mazwell, A. B. Farnham, Clarence C. Trott and J. P. O'Donnell, all of Portland.

LISBON, N. D.—The Lisbon El. & Pwr. Co. has been incorporated with a capital stock of $30,000 by Frank B. Thompson and others.

ERWIN, TENN.—The Erwin El. Lt. & Pwr. Co. has been organized with a capital stock of $15,000 by T. Fred Johnson, T. H. Morris and others. The company proposes to install and operate an electric-light plant.

WACO, TEX.—The City El. Co. has been chartered with a capital stock of $10,000 by William Hodges, C. J. Hodges and J. E. Kuykendall.

WILD ROSE, WIS.—The Wild Rose El. Lt. & Pwr. Co. has been incorporated with a capital stock of $5,000 by J. A. Peterson, F. V. Johnson and others.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 18, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,078,081. TYPEWRITER; G. B. Baker, Duluth, Minn. App. filed Oct. 3, 1912. Has hollow-type wheel containing the rotor of a small electric motor.

1,078,233. INTERRUPTER FOR IGNITION DYNAMOS; H. H. Wixon, Chicago, Ill. App. filed March 4, 1910. The primary circuit is interrupted first by one pair of contacts and then by another pair so as to distribute the injurious sparking effect.

1,078,577. TELEPHONE BRACKET; F. Fox, New York, N. Y. App. filed July 1, 1909. Parallel supporting arms in frictional engagement with each other.

1,078,619. ELECTRIC FURNACE; A. E. Greene, Chicago, Ill. App. filed Jan. 23, 1911. Solid-metal resistor forms the secondary, and the primary winding in inductive relation thereto also forms a resistor.

1,078,620. PRINTING-TELEGRAPH RECEIVER; G. S. Hiltz, New York, N. Y. App. filed March 21, 1912. "One-wire" machine requiring only one transmission circuit.

1,078,622. SYSTEM OF CONTROL; H. D. James, Pittsburgh, Pa. App. filed Sept. 19, 1910. For automatically removing resistance from the secondary of an alternating-current induction motor.

1,078,626. ELECTRICALLY OPERATED DUPLICATE TYPEWRITING MACHINE; B. Kelley, Syracuse, N. Y. App. filed Jan. 7, 1910. Combination of system of transmitter keys, a relatively smaller number of circuit closers selectively operated thereby, and a smaller number of line circuits.

1,078,627. MUSICAL INSTRUMENT; J. F. Kelly, Pittsfield, Mass. App. filed April 29, 1911. Plates of magnetic substances are vibrated by the periodic attraction of electromagnetic devices to produce musical sounds.

1,078,629. MERCURY-VAPOR RECTIFIER; J. W. Lewis, Wilkinsburg, Pa. App. filed Oct. 18, 1909. The mercury which is vaporized is confined to a small compartment or chamber within the rectifier bulb.

1,078,630. LOCOMOTIVE; M. Mahoney, Wilkinsburg, Pa. App. filed March 20, 1911. Two four-wheel motor-equipped trucks and two independent radius bars interposed between the trucks and provided with yielding connections to obviate bumping strains.

1,078,631. RAILWAY LOCOMOTIVE; M. Mahoney, Wilkinsburg, Pa. App. filed March 20, 1911. Radius bar pivoted between the main truck and the four-wheel end truck and provided with means for relieving it of longitudinal compression strains.

1,078,633. INSULATOR; J. E. Mateer, Wilkinsburg, Pa. App. filed Aug. 8, 1908. For high voltage leads; series of overhanging insulating skirts with an overhanging metal cap at the top.

1,078,639. WORK-TABLE FOR ELECTRIC WELDING MACHINES; R. C. Pierce, Cincinnati, Ohio. App. filed Dec. 13, 1912. Vertically and swingingly adjustable supporting table.

1,078,641. MERCURY-VAPOR APPARATUS; J. C. Pole, New York, N. Y. App. filed Feb. 1, 1912. Conical valve prevents shock to the fragile containing vessel due to the shifting of the position of the fluid in the vessel.

1,078,643. TROLLEY WHEEL; J. S. Randolph, Glencoe, Ohio. App. filed Jan. 16, 1913. Manually releasable pivoted jaw carried by the trolley harp and overhanging the trolley wire.

1,078,647. ANCHOR STRUCTURE FOR OVERHEAD LINES; T. Varney, Pittsburgh, Pa. App. filed Oct. 13, 1909. For holding the terminal of the messenger wire which supports the trolley wire under very heavy tension and electrically insulated.

1,078,653. SHIP'S TELEGRAPH; F. W. Wood, New York, N. Y. App. filed June 30, 1910. A synchronous motor moves a semaphore in direct accordance with the movement of the wheel or helm, thereby to signal the ship's course to another ship.

1,078,654. ELECTRICAL SYSTEM OF DISTRIBUTION; J. L. Woodbridge, Philadelphia, Pa. App. filed Sept. 29, 1911. An electrolytic valve prevents current from flowing into the battery from the circuit, but upon an abnormal reduction of the circuit voltage permits the battery to discharge into the circuit.

1,078,656. LAMINATED CONTACT BRUSH; C. Ambruster, Roslyn, Pa. App. filed March 7, 1912. Laminations having projecting portions free for deflection and provided with beveled ends.

1,078,675. ELECTRICAL WELDING APPARATUS; J. A. Heany, Washington, D. C. App. filed July 28, 1913. A timing device actuated by the impact of the welding arms regulates the duration of the welding current.

1,078,685. TELEPHONE-EXCHANGE TRUNKING SYSTEM; A. E. Keith, Hinsdale, Ill. App. filed July 21, 1908. Automatic selection of idle trunks in a telephone exchange system.

1,078,690. AUTOMATIC TELEPHONE SYSTEM; F. Newforth, Jr., Chicago, Ill. App. filed Jan. 17, 1912. Automatic selecting and connecting switches establish the connection between the calling and a called subscriber's line.

1,078,693. LOCK ATTACHMENT FOR SNAP SWITCHES; C. D. Platt, Bridgeport, Conn. App. filed Feb. 12, 1913. A projecting center on the switch spindle assists in guiding the projections on the operating key into the seats provided therefor.

1,078,711. SYSTEM OF ELECTRICAL TRANSMISSION; J. B. Whitehead, Baltimore, Md. App. filed Sept. 15, 1910. Each leg of the circuit is made up of a plurality of separated equipotential conductor strands mounted symmetrically about a longitudinal axis.

1,078,721. ELECTRICAL SYSTEM OF DISTRIBUTION; G. Crosby, New York, N. Y. App. filed Oct. 8, 1908. Maintains a substantially constant charging current during all periods of battery charging and materially cuts down the charging current when battery has reached a proper state of charge.

1,078,746. AMPLIFYING CASE FOR MICROTELEPHONES; W. B. Oliver, Collingswood, N. J. App. filed Sept. 30, 1910. Portable case containing all the elements of a microtelephone and including also an amplifying chamber.

1,078,762. TROLLEY-POLE SUPPORT; J. M. Anderson, Boston, Mass. App. filed June 21, 1909. Aims to provide uniform upward pressure and to cushion the trolley pole in case the wheel leaves the wire.

1,078,763. ELECTRICAL CONNECTION; J. M. Anderson, Boston, Mass. App. filed March 23, 1912. High amperage plug connection for use on storage battery charging circuits and the like.

1,078,766. SPRING TERMINAL CLIP; C. Barr, Chicago, Ill. App. filed April 5, 1913. Spaced spring arms having wire-receiving recesses adapted to register when the arms are pinched together.

1,078,772. CALL-REGISTER; H. P. Clausen and W. T. Curtis, Chicago, Ill. App. filed March 15, 1910. Registering mechanism is operated manually by the subscriber, central being notified by a signaling device associated with the register that the register has been moved one step.

1,078,782. ELECTRICAL GUN-FIRING MECHANISM; I. F. Galindez, Buenos Aires, Argentina. App. filed Dec. 7, 1912. Recoil of the gun winds up a spring motor which drives a generator for furnishing the firing current.

1,078,785. AUTOMATIC RHEOSTAT; H. M. Grossman and J. Wynn, Jr., Canton, Ohio. App. filed March 25, 1912. Pressure produced by a motor-driven fan or pump shifts a mercury column to cut in or out resistance

1,078,787. MEDICAL ELECTRIC-CURRENT REGULATOR; A. J. Hoenes, Murray, Utah. App. filed Oct. 21, 1912. Moistened sponge within a glass tube forms the resistance element and the sponge is compressed more or less to vary the current flow.

1,078,788. GALVANIC CELL; M. L. Kaplan, Brooklyn, N. Y. App. filed June 2, 1913. Of the Leclanché type, containing as a depolarizing agent dihydrated manganese peroxide in fine dense powder of grayish blue color.

1,078,813. LAMP SOCKET; C. A. Vetter, Pittsburgh, Pa. App. filed Sept. 24, 1912. "Keyless" socket in which current is controlled by rotating the lamp, holding base within its socket.

1,078,815. LIMIT SWITCH; H. J. Wiegand, Milwaukee, Wis. App. filed Aug. 27, 1908. Provides means for shifting the switch quickly when once it is operated by the slowly moving operating member.

1,078,843. PROTECTED-CABLE-TERMINAL BOX FOR TELEPHONE SYSTEMS; T. B. Farmer, Baltimore, Md. App. filed Nov. 22, 1909. Has inclosed fuse links fitting in slots formed in a carbon ground strip.

1,078,859. MERCURY-VAPOR APPARATUS; F. G. Keyes, Boston, Mass. App. filed Feb. 11, 1913. A funnel-shaped diaphragm serves to maintain the normal quantity of electrode material at the electrode.

1,078,863. AUTOMATIC SYNCHRONIZER; R. C. Leake, Lakeland, N. Y. App. filed Aug. 10, 1908. Automatically closes switch to throw the machines into circuit at about the instant when the voltage values and the alternations are approximately the same.

1,078,877. DYNAMO-ELECTRIC MACHINE; H. H. Ralston, Norwood, Ohio. App. filed March 1, 1905. Puts spacing blocks of insulating material between the commutator leads intermediate to their ends.

1,078,899. SELECTIVE TELEGRAPH SYSTEM; E. A. Burlingame, Boston, Mass. App. filed Jan. 6, 1910. Includes means for producing currents of different polarity and strength.

1,078,913. ARC-LAMP; R. Fleming and C. A. B. Halvorson, Jr., Lynn, Mass. App. filed March 6, 1905. Produces a down draft past the arcing end of the upper electrode.

1,078,922. LIGHTNING ARRESTER; J. O. Holton, Springfield, Mo. App. filed July 30, 1912. Arrester members spaced apart and having upwardly converging walls.

1,078,971. AUTOMATIC WEIGHING MACHINE; E. G. Thomas, Boston, Mass. App. filed Aug. 28, 1897. Has power-driven mechanism for opening the valve which controls the delivery of material to the scale.

1,078,978. SIGNAL APPARATUS; C. Williamson, San Francisco, Cal. App. filed Oct. 5, 1912. By which passenger, upon boarding car, may signal the motorman the street or station at which he wishes to stop.

1,078,984. SIGNALING MECHANISM; C. E. Beach, Binghamton, N. Y. App. filed June 4, 1912. Signal formulating and controlling mechanism for fire-alarm boxes, etc.

1,078,985. SIGNALING SYSTEM; C. E. BEACH, Binghamton, N. Y. App. filed May 6, 1912. Causes sounding of all the local fire alarm devices and the general or fire brigade alarm devices.

1,079,008. DYNAMO-ELECTRIC GENERATOR; G. and L. Inrig, London, Eng. App. filed July 20, 1912. For charging batteries, etc.; breaks the circuit of the dynamo when the speed falls below or rises above certain predetermined speeds.

1,079,010. SAMPLER-OPERATING DEVICE; L. E. Jones, Anaconda, Mont. App. filed April 29, 1912. The cutter of the sample is automatically reciprocated across the path of the stream of material.

1,079,013. ELECTRIC CIRCUIT CONTROLLING APPARATUS FOR TRAIN LIGHTING AND SIMILAR SYSTEMS; E. H. M. Langley and E. W. Price, Aston, Birmingham, England. App. filed July 25, 1911. Master switch for producing "no-light," "half-light" or "full-light" effects.

1,079,018. FUSE AND FUSE CARRIER; T. E. Murray, New York, N. Y. App. filed April 30, 1913. Fuse is looped over separated conducting plates mounted on a wedge-shaped insulating carrier.

1,079,028. ELECTRIC-LAMP SOCKET; M. Schwartz, Chicago, Ill. App. filed Jan. 31, 1912. Permutation lock for securing the lamp in the socket.

1,079,059. TROLLEY COLLECTOR SHOE; W. H. Miller, Emaus, Pa. App. filed July 3, 1913. Shank mounted on the oustanding arm of the supporting structure, notched at one end to fit the socket and carrying a transverse shoe at its opposite end.

1,079,066. ELECTRIC SOLDERING IRON; M. H. Rice, New Rochelle, N. Y. App. filed May 1, 1913. The soldering tip secures and locates the heating unit in the containing casing.

1,079,073. ELECTRIC-WELDING MACHINE; J. C. Swanson, C. A. Linden and C. A. Carlson, Jamestown, N. Y. App. filed Feb. 10, 1913. Has hollow-wheel electrodes.

1,079,079. PROCESS FOR THE PREPARATION OF METALLIC MAGNESIUM; R. W. Wallace and E. Wassmer, London, Eng. App. filed Aug. 18, 1913. Electrolyzes a mixture of chloride and sulphide of magnesium in an electrolytic bath.

1,079,088. FLASH-LIGHT; F. Wysocki, Chicago, Ill. App. filed May 1, 1913. Located in the handle of a cane or the like.

1,079,116. ELECTROMECHANICAL WARP STOP MOTION FOR LOOMS; J. F. Dustin, Fulton, N. Y. App. filed Feb. 2, 1911. Circuit rendered operative to stop loom by a released detector heddle in a harness when the latter is down.

1,079,130. TERMINAL CONNECTOR FOR CONCENTRIC CONDUCTOR CABLES; F. Kratz and R. Wagner, Stuttgart, Germany. App. filed May 1, 1913. Pressure-applying device forces the conductors into intimate connection with appropriate abutments.

1,079,156. TELEPHONE EXCHANGE SYSTEM; W. Aitken, Liverpool, Eng. App. filed June 25, 1913. Substation meter can be set to limit automatically the number of calls which can be made to a predetermined number.

1,079,161. PRINTING PRESS; J. Bucher, Kansas City, Mo. App. filed April 25, 1912. Heater for the rotary ink plate of a press for use in cold weather.

1,079,185. ELECTRIC WATER HEATER; J. Polak, New York, N. Y. App. filed Feb. 1, 1913. Concentric heating elements with water spaces between.

1,079,213. ELECTRIC REGULATOR FOR INCUBATORS; C. C. Carter, Chapin, Ill. App. filed Dec. 10, 1912. Controls circulation of outside air to the incubator according to temperature within the incubator.

1,079,225. ELECTRIC HEATER; W. Dubilier, New York, N. Y. App. filed Dec. 19, 1912. Fastening devices which hold the sectional framework together also serve to secure the heat-radiating element in place in the ramework.

1,079,229. ELECTRICALLY CONTROLLED INDICATOR; W. L. Fitzgerald, Philadelphia, Pa. App. filed Sept. 19, 1911. For indicating rise and fall of a fluid.

1,079,233. ELECTRICAL SWITCH; W. J. Gagnon, Bridgeport, Conn. App. filed July 21, 1909. Push-button pendent switch with a single push-button.

1,079,235. ATTACHMENT PLUG; G. W. Goodridge, Bridgeport, Conn. App. filed Jan. 23, 1913. Screw-shell type; wires passed through hollow rivets which secure the terminals to the insulating body.

1,079,239. INSULATOR; J. R. Harris, Crafton, Pa. App. filed Dec. 16, 1912. Two-part insulator whose parts are held together loosely by a tube through which the securing nail or screw is passed.

1,079,250. VAPOR ELECTRIC DEVICE; F. W. Lyle, Saugus, Mass. App. filed June 18, 1910. Has a refractory cap over the vaporizable cathode.

1,079,259. SYSTEM OF TRANSMISSION; H. Nehlsen, Berlin, Germany. App. filed March 20, 1911. Includes a flywheel motor generator set.

1,079,271. PUSH-BUTTON SWITCH; J. H. Smedley, Narberth, Pa. App. filed March 26, 1913. Combines a signal lamp with a doorbell push button.

1,079,276. ELECTRIC MASSAGE APPARATUS; J. Thorell, Portland, Ore. App. filed Jan. 23, 1913. Heel plate of the operator makes contact with floor-pad terminal.

1,079,309. SIGNAL BOX; C. E. Beach and H. W. Doughty, Binghamton, N. Y. App. filed May 25, 1911. Non-interference signal box for fire-alarm systems.